

AVIATION WEEK

A MCGRAW-HILL
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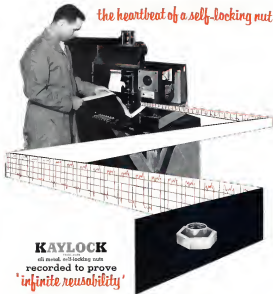
Special Reports:

- IATA Meeting
- Canada Air Show

BOEING KC-135 TANKER, 707 TRANSPORT



Helicopters Carry War to Algerian Rebels



the heartbeat of a self-locking nut

KAYLOCK
all metal, self-locking nuts
recorded to prove
'infinite reusability'

Keylock Nuts withstand the rigors of the most accurate torque testing machine ever devised. We know. We designed and custom-built special automatic equipment which conducts self-locking torque tests, records the readings on continuous tapes; proves irrefutably the exceptional reusability of Keylock Nuts.

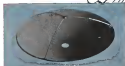
SELF-LOCKING NUTS AND LOCKING DEVICES ARE CONFORMING TO
MILITARY AIR FORCE-NAVY SPECIFICATIONS AND S AND ENDS



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IT DISHES
OUT GUNFIRE—

and can take an atomic blast



*Another Example Of Plastic Pioneering
by Goodyear Aircraft Corporation*

This parabolic radar reflector will soon direct anti-aircraft firepower aboard a Navy vessel.

It weighs a mere 30 pounds—yet is able to withstand an atomic blast load of 22 tons.

How come it can take it as well as dish it out?

The key lies in integrated design—using a single-piece die-molded structural plastic to replace the host of detailed sheet-metal assemblies usually employed in such construction.

Developed by Goodyear Aircraft under contract with the Navy Bureau of Ordnance and Bell Telephone Laboratories, these plastic radar reflector dishes have proved they better their metal forerunners—and more.

They are lighter, stronger—eliminate complicated metal-work assembly—use two parts to replace many.

Already produced in diameters up to 72 inches, they are an excellent example of the plastic molding skills and techniques of Goodyear Aircraft Corporation.

Why not let such experience pave the way to overcoming difficult design and assembly problems facing you? By cutting in Goodyear Aircraft, you will gain from this proved ability to fabricate such structures from metal, plastic and structural madmix materials in combinations that pay off in strength-to-weight ratio, simplicity and exacting performance.

For information, write: Goodyear Aircraft Corporation. Plants in Akron, Ohio, and Wickliffe Park, Arizona.

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GOODYEAR AIRCRAFT

WARREN WIRE TAKES OVER AS HIGH TEMPERATURE SPECIALIST



**In all electrical wiring and cables
for aircraft, missiles and rockets
we've beat the Devil at his own game**

WIND... HOOK UP... INSULATE! From the smallest component to the entire connecting system — all can be integrated in one complete Class H system — to withstand heat up to and far beyond +600°F ambient. What's more, all these Warren Wire products are impervious to fuels, chemicals and solvents; have superior abrasion and cut-through resistance; and withstand cold to below -85°F.

Only Warren Wire can provide a complete

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stamped, or
color-coded
Cable
Systems



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including
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and every
other electrical
component!

CABLES

MIL-W-7139-A

WW600 — for Identification by Tagging
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Identification

Be Sure — Be Safe with RFI-500 — and in addition, Save Time — Save Weight — Save Money with RFI-500. The world's most rugged, best-resistant and abrasion-resistant cables of its type. The silver-plated, copper-kernel of each is protected by impervious, Teflon-treated glass and glass braid. With RFI-500, you save time, weight and money because tagging or "tagging out" is no longer necessary! Color coding, through 10 solid colors and an unlimited number of color combinations, permits instant circuit identification anywhere it is used — or if you prefer to code with standard marking equipment, there is White RFI-500, RFI-100, colored "potpourri" braid, or the standard tag identification. Send for samples and Specification Chart "WW500/WW600".

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Type E and EE

WARRENITE Teflon-wrapped
WARRENEX with extruded Teflon coating
GLASTITE Teflon-wrapped; glass braided

A complete assortment of standard, dimension, color and color combinations — to fit every need. All three types possess superior dielectric, moisture and resistance to water absorption; are unaffected by fungus. Where flexibility is important, these wires perform perfectly. Type E and EE sizes have 600 and 1000 volt ratings respectively. Send for samples and Specification Chart "WWLE".

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precision-made
cockpit enclosures to
America's air arm**



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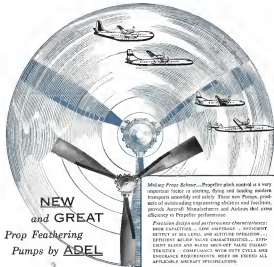


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Pamphlet outlining
details of installation
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Aircraft Equipment
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A DIVISION OF DOWNEY INDUSTRIES CORPORATION

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PART OF
ROHR'S
MULTI-MILLION
DOLLAR
TOOL KIT**

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Today, with this and hundreds of other heavy manufacturing machines, Rohr produces over 50,000 different parts for aircraft of all types. That is, of course, in addition to Rohr's being recognized as the world's largest producer of ready-to-install power packages for airplanes.

For design and engineering know-how, for full production facilities look to Rohr to build something into the aircraft parts you need.



In addition to the Lockheed C-130 Hercules shown here, Rohr builds power packages for many other leading commercial and military planes which have made Rohr famous as the

**WORLD'S LARGEST PRODUCER
OF READY-TO-INSTALL
POWER-PACKS FOR AIRPLANES**



PLANTS IN OYLA VISTA AND RIVERSIDE, CALIFORNIA; WYCK, GEORGIA—BORN TO BE IN ARBURN, WASHINGTON

**Whittaker has valves in production
for your missile system**



In addition to our valves for aircraft, Whittaker is now producing a wide variety of valves for missile systems.

The following list shows some of the units now in production. The wide diversification of this line—plus Whittaker's extensive experience in the strict operational tolerances which characterize missile equipment—results in exceptional reliability and performance. Although the units listed below are for specific installations, they can be easily adapted for use with different pressures and line sizes.

We invite you to review this list. To obtain detailed information regarding any of these units simply fill out and return the coupon at the bottom of this page.

Whittaker's experience can be of immeasurable help in the solution of your missile design problems.

CODE	VALVE TYPE	LINE SIZE	DESCRIPTION
1	Ball	1/2" NPT	Ball Valve
10	Ball	1"	Ball Valve
15	Ball	1 1/2"	Ball Valve
20	Ball	2"	Ball Valve
25	Ball	2 1/2"	Ball Valve
30	Ball	3"	Ball Valve
35	Ball	3 1/2"	Ball Valve
40	Ball	4"	Ball Valve
45	Ball	4 1/2"	Ball Valve
50	Ball	5"	Ball Valve
55	Ball	5 1/2"	Ball Valve
60	Ball	6"	Ball Valve
65	Ball	6 1/2"	Ball Valve
70	Ball	7"	Ball Valve
75	Ball	7 1/2"	Ball Valve
80	Ball	8"	Ball Valve
85	Ball	8 1/2"	Ball Valve
90	Ball	9"	Ball Valve
95	Ball	9 1/2"	Ball Valve
100	Ball	10"	Ball Valve
105	Ball	10 1/2"	Ball Valve
110	Ball	11"	Ball Valve
115	Ball	11 1/2"	Ball Valve
120	Ball	12"	Ball Valve
125	Ball	12 1/2"	Ball Valve
130	Ball	13"	Ball Valve
135	Ball	13 1/2"	Ball Valve
140	Ball	14"	Ball Valve
145	Ball	14 1/2"	Ball Valve
150	Ball	15"	Ball Valve
155	Ball	15 1/2"	Ball Valve
160	Ball	16"	Ball Valve
165	Ball	16 1/2"	Ball Valve
170	Ball	17"	Ball Valve
175	Ball	17 1/2"	Ball Valve
180	Ball	18"	Ball Valve
185	Ball	18 1/2"	Ball Valve
190	Ball	19"	Ball Valve
195	Ball	19 1/2"	Ball Valve
200	Ball	20"	Ball Valve
205	Ball	20 1/2"	Ball Valve
210	Ball	21"	Ball Valve
215	Ball	21 1/2"	Ball Valve
220	Ball	22"	Ball Valve
225	Ball	22 1/2"	Ball Valve
230	Ball	23"	Ball Valve
235	Ball	23 1/2"	Ball Valve
240	Ball	24"	Ball Valve
245	Ball	24 1/2"	Ball Valve
250	Ball	25"	Ball Valve
255	Ball	25 1/2"	Ball Valve
260	Ball	26"	Ball Valve
265	Ball	26 1/2"	Ball Valve
270	Ball	27"	Ball Valve
275	Ball	27 1/2"	Ball Valve
280	Ball	28"	Ball Valve
285	Ball	28 1/2"	Ball Valve
290	Ball	29"	Ball Valve
295	Ball	29 1/2"	Ball Valve
300	Ball	30"	Ball Valve
305	Ball	30 1/2"	Ball Valve
310	Ball	31"	Ball Valve
315	Ball	31 1/2"	Ball Valve
320	Ball	32"	Ball Valve
325	Ball	32 1/2"	Ball Valve
330	Ball	33"	Ball Valve
335	Ball	33 1/2"	Ball Valve
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345	Ball	34 1/2"	Ball Valve
350	Ball	35"	Ball Valve
355	Ball	35 1/2"	Ball Valve
360	Ball	36"	Ball Valve
365	Ball	36 1/2"	Ball Valve
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415	Ball	41 1/2"	Ball Valve
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425	Ball	42 1/2"	Ball Valve
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450	Ball	45"	Ball Valve
455	Ball	45 1/2"	Ball Valve
460	Ball	46"	Ball Valve
465	Ball	46 1/2"	Ball Valve
470	Ball	47"	Ball Valve
475	Ball	47 1/2"	Ball Valve
480	Ball	48"	Ball Valve
485	Ball	48 1/2"	Ball Valve
490	Ball	49"	Ball Valve
495	Ball	49 1/2"	Ball Valve
500	Ball	50"	Ball Valve
505	Ball	50 1/2"	Ball Valve
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550	Ball	55"	Ball Valve
555	Ball	55 1/2"	Ball Valve
560	Ball	56"	Ball Valve
565	Ball	56 1/2"	Ball Valve
570	Ball	57"	Ball Valve
575	Ball	57 1/2"	Ball Valve
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585	Ball	58 1/2"	Ball Valve
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595	Ball	59 1/2"	Ball Valve
600	Ball	60"	Ball Valve
605	Ball	60 1/2"	Ball Valve
610	Ball	61"	Ball Valve
615	Ball	61 1/2"	Ball Valve
620	Ball	62"	Ball Valve
625	Ball	62 1/2"	Ball Valve
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670	Ball	67"	Ball Valve
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685	Ball	68 1/2"	Ball Valve
690	Ball	69"	Ball Valve
695	Ball	69 1/2"	Ball Valve
700	Ball	70"	Ball Valve
705	Ball	70 1/2"	Ball Valve
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740	Ball	74"	Ball Valve
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805	Ball	80 1/2"	Ball Valve
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815	Ball	81 1/2"	Ball Valve
820	Ball	82"	Ball Valve
825	Ball	82 1/2"	Ball Valve
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835	Ball	83 1/2"	Ball Valve
840	Ball	84"	Ball Valve
845	Ball	84 1/2"	Ball Valve
850	Ball	85"	Ball Valve
855	Ball	85 1/2"	Ball Valve
860	Ball	86"	Ball Valve
865	Ball	86 1/2"	Ball Valve
870	Ball	87"	Ball Valve
875	Ball	87 1/2"	Ball Valve
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920	Ball	92"	Ball Valve
925	Ball	92 1/2"	Ball Valve
930	Ball	93"	Ball Valve
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955	Ball	95 1/2"	Ball Valve
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975	Ball	97 1/2"	Ball Valve
980	Ball	98"	Ball Valve
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The COURSE DIRECTOR consists of a computer which gives precise steering data and a compass slaved gyro which provides stabilized, accurate, directional information.

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Aircraft Radio Corporation SCOTCH, NEW JERSEY

Unit saves 2 1/4 man hours
on each shaft machined from



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VERTICAL TRACTION SHAFT

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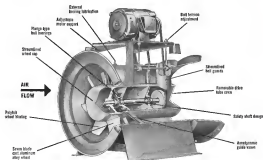
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With volumes from 1,700 to 170,000 CFM—static pressures up to 3 1/4"—48 inch, Vaneaxial or Tube Axial, direct-connected or V-belt driven, with wheel diameters from 12" to 72"

- **Space Saver**—compact Axial Flow design permits installation directly into duct work.
- **Improved performance**—no overloading, horsepower factors permits use of smaller motors.
- **Quiet operation**—rigid physical construction absorbs continuous trouble-free operation.

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Small Inlet Vaneaxial Fan specially designed for gas with very strong required for post gas without it.

another example of how **RYAN BUILDS BETTER**



RYAN TO BUILD DC-8 JET PACKS AND PYLONS

Jet Packs. Ryan has been selected by the Douglas Aircraft Company to manufacture complete jet power packs and pylons for the new DC-8 commercial airliner. Substantial orders for these 250 mph Jetpacks have been placed by 11 major airlines.

Broad Experience. The Douglas order, initially \$80 million, is the result of Ryan's outstanding record of performance in the design and production of jet engine components, afterburners, rocket nozzles, nozzles and exhaust equipment for turbo-compound and piston engines.

Engineering. Ryan is devoting a substantial amount of effort to working with Douglas personnel in the engineering of the DC-8 jet packs and the supporting pylons. Ryan has extensive experience in the construction of power plants and airborne structures.

Established, Equipped. A pioneer in strength, Ryan understands the industry's requirements and builds them as only an aircraft company can. Ryan has the personnel and facilities to perform a complete job of engineering, production and evaluation of specialized structures such as jet packs and pylons.

With a background of 22 years of experience in aviation, Ryan excels in designing and producing high quality aircraft, power plants and engines, built at low cost, delivered on time.

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AERONAUTICAL COMPANY
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Mary Hilkey Parson, Iowa State
Judy E. Wilson

► Defense Department study calls for better utilization of management skills in weapons development.

►BATA director general takes calm view of capacity implications, but emphasizes breadth of increase

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*About 1,500 F-84Fs will be retrofitted with simpler system, and newer version for F-105	

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EDITORIAL

International Hotel Rate Position 21

... ..

DAVID Forling's 44-110 Gradenko is the largest and is making its mark built from Boeing Commercial Aircraft of Seattle, Wash. Boeing 747 has

post links only in background. © L. (Des) Lanth, Boeing senior eng.

mental test pilot, and A. M. (Tex) Jonathan, chief of flight test, were at the controls of the KC-135 on the 1 hr. 18 min. flight. KC-135 is currently

production for SAC is first job inquiry to cover off production line.

Bottom Credits

57—Wide World, 136, 117—Benton Group

 ΔF_{CP1} values of the four points

JOURNAL WEEK • SEPTEMBER 17, 1996 • Vol. 45, No. 12

Hansen A&P and ABC



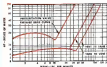
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EDITORIAL

International Mail Rate Problem

(Sir William Hildes has called the attention of the 17th Annual General Meeting of the International Air Transport Association to a grave matter that will face them within the next 12 months when the Universal Postal Union will hold its congress at Ottawa to consider setting international air mail payments to airlines that carry foreign mail. This is a matter on which Sir William has been eloquent in the past and his words express the problem well.)

"Government delegates go to these congresses as plenipotentiaries, with power to sign a Postal Convention which thereby becomes a binding agreement between governments. These government delegates are postal officials and are, therefore, in effect, the voice of the air mail service. This is a very strange situation. The user of the service sits by the airport without the transporter having any say in the matter at all. And you can't talk to a Postal Conference ten minutes without being told in tones of awe that 'congress is supreme'."

"There is only one thing for you to do. That is to see that the top officials of your governments—the prime minister or, in certain cases, the minister of finance fully appreciate the situation, so that they can instruct the post office people, if they see fit, to vote in the right sense when they go to the congress. This is something which each of you must do to enable us to accomplish our objective of not losing more revenue in performing this service for the public. If each of you says to him- or herself, I find it a little difficult to speak to my government and I shall rely on the member sitting on my right and the member sitting on my left, then you may as well reconcile yourselves to a loss of many millions of dollars."

"Remember, we are not asking for an increase in rates. We are only asking that the present rates, already

smashed down some years ago at the Brussels Congress, should not be further reduced. Most airlines have a thin profit margin or none. If air mail rates are to be cut still further, we shall be in a bad way."

"Such an act would only mean that many of the major airlines would require subsidizing by their governments and that money would have to come out of the pockets of the taxpayer. And remember to tell your minister that it would be out of the pockets of the taxpayer of those countries which provide international air transport and would go largely into the coffers of the post office of the countries which do not have major air networks. I hope some of the large governments will make it clear that if there is an attempt at Ottawa further to cut the rates, there will be no signed Postal Convention."

"Remember that, since Brussels when the rates were pulled down without consultation, the airlines have collectively decided to prevent railroads of dollars for the purchase of jets. This will increase the value of the main commodity we sell, namely speed, by 40%. That treatment of value benefits the postal administrations also lately by increasing their efficiency in the eyes of the public."

"Let me get these facts much quicker, however, directly, private relationships, contact with fellow men are all intended and speeded up. It's a funny moment to choose for trying to cut our small postal revenues yet again."

"We hope the international airlines led by Sir William coming and here the congress at Ottawa with the solid backing of their governments to resist any further attempts to slash international rates and airlines for carrying foreign mail."

—Robert Hays



After all! Fafnir may or not, you should relax occasionally!



Fafnir Super Precision ball bearing (left) under stress of an airplane.

Close contact with the aircraft industry stimulates more than casual interest in its rapidly advancing developments. Through nearly forty years of collaboration, Fafnir Bearing Specialties has absorbed some of the spirit responsible for aviation's progress. A case in point is the development of the Fafnir Jet Engine Ball Bearing. This frequently called masterpiece in bearing design and construction involves a radial and a thrust bearing assembled in a one-piece self-aligning outer ring. The Fafnir Bearing Company, New Britain, Connecticut

FAFNIR AIRCRAFT BEARINGS

FIRST—at the turning points
in aircraft design



WHO'S WHERE

In the Front Office

Robert E. Cass, former chairman and president, now chairman and chief executive of Lockheed Aircraft Corp., Burbank, Calif. Casswell & Cass, formerly executive vice president, now president. Also established this year two presidents: Charles A. Baker, Jr., Boeing and Boeing, and Charles C. Chapman, McDonnell Douglas. Neil L. Ellis, head, engineering. Carl B. Spies, 100 percent, former assistant to the chairman. Daniel J. Bouchard, executive vice president. A. C. Robinson, executive vice president in general manager of Lockheed's George Dornan.

Dr. Arnold O. Bertram, president of Bellman Instruments Inc., a division of Continental Co. Ltd.

McMurry E. Guba, a director of The General Corp. Lin Hughes, chief of the Civilian Aeronautics Administration. John E. Northrup, also his support.

George H. Hays, president of South Island (Hawthorne) Products, Inc., Plainfield, N.J. Morris G. Gage and Zoltan H. Hays, president and chief executive officer, South Island Products, Inc., Plainfield, N.J.

Dore Gaudin, vice president, general manager and industrial products, General Electric Co., Hartford, Conn.

N. G. Warren and Gen. Gordon T. St. John, USAF, and vice president, General Electric Co., Los Angeles, Calif.

Joseph E. Hilditch, vice president and general manager, General Electric Co., Los Angeles, Calif.

Honors and Elections

George F. W. Johnson, director, General Electric Co., Los Angeles, Calif. Thomas W. H. Johnson, director, General Electric Co., Los Angeles, Calif. The 1975 for his paper, "The Future and the Development of the New Turbine Engines".

John B. Hays, Jr., president, and General Electric Co., Los Angeles, Calif. Northern California, Inc., San Francisco.

More removed the State's highest award, the Distinguished Public Service Award, for their significant contribution to the design and production of the Navy's new aircraft, used for aircraft gun mounts.

Changes

Foto J. Hays, manager projects, and Paul E. Hays, manager projects, and all members of the Air Force Technical Mission Planning Operation (ATMPO) of General Electric Company's Defense Engineering Division. The ATMPO's headquarters will be in California at a location to be decided. Charles D. Hays, executive vice president, General Electric Co., Los Angeles, Calif. General Electric Co., Los Angeles, Calif. General Electric Co., Los Angeles, Calif.

Joseph E. Hays, executive vice president, General Electric Co., Los Angeles, Calif. General Electric Co., Los Angeles, Calif.

(Continued on p. 20)

INDUSTRY OBSERVER

(Barrett's Note: This column was written by AVIATION WEEK's staff attending the SBAC display at Farnborough. Pictures on pages 51-53.)

► Glider launch production order has been drastically cut back to about 100 gliders, reflecting a slow decline in Royal Air Force's air warfare fighter capabilities. Launch development plans also were stopped in consideration of a proposal for a three-engine model using an advanced fuselage and advanced Bristol Olympus engines in the 35,000-hp thrust class to provide good performance performance.

► Project to build Avon of Canada's CF-105 supersonic delta wing all-weather fighters in England also has been stopped. The large supersonic delta would have utilized an American jet-engine nozzle system and Bristol-built Olympus engines. No plans exist now to provide the RAF with a supersonic all-weather fighter in the CF-105 class.

► New version of the English Electric supersonic day fighter is P.13, with a switch in configuration from the Armstrong Siddeley Sapphire to a pair of turbofans. Rolls-Royce Avon will also be considered. This puts the P.13 in the same power class as the McDonnell F-101, but with a much shorter range. Three P.13s have already been built.

► Rolls-Royce reverse thrust device demonstrated experimentally in Hawker Hunter by test pilot Jim Haworth was part of a checklist aimed at close off tail pipe exit and direct thrust through forward located on both sides of the rear fuselage. In normal flight, the device is closed, but in the case of a backward, opening lower vents, and thus close to reverse thrust. Rolls claims up to 30% thrust reversal effect. Unit is being developed along with aircraft for eventual commercial applications on the Conquest by-pass engine in Boeing and Douglas jet transports.

► Paves of Folland Gnat now is tied mainly to possibilities that the Royal Air Force may place an order for a trainer version under development (AW Sept. 16, p. 28). Gnat trainer will be able to develop transonic speed, but not for fighter pilots and will cost much less than its competitor, the Hawker Hunter trainer. More, small contract now, seems to be the Gnat as a trainer, but there is some evidence that development work will be undertaken by other services. Armed version of the Gnat has flown close to 30,000 ft and climb successfully up to Mach 1.2.

► Rolls-Royce is developing two new turboprop engines, RB-380 is believed to be a small, high thrust weight ratio turboprop in the low class, while the RB-380 is an extremely lightweight turboprop, probably in the 25,000-hp thrust class.

► De Havilland Comet turboprop now running at 15,000-hp thrust with a design speed of about 25,000 ft has not yet been in service applications, providing a major reduction of low thrust's engine development program for air transport engine development in the response speed range.

► Shorter Rotax supersonic turbojet powered by a turboprop and axial compressor is now the only one left in this field. Bristol Avon project has been cancelled because of reasons direct of current British government.

► Most informed people in British aviation are still awaiting a government decision to move into the Vickers 1800 jet transport project. Government decision may be based on the fact that the Vickers transports weight has grown to 250,000 lb, and would have required 3,000-hp engines. Douglas and Boeing jet transports that have covered the bulk of the world market in this class are now over the Vickers weight and 9,000-hp engines are needed at most key airports in the long-range jet international traffic pattern.

► Although several British engine firms are doing research on jet engine powerplants for aircraft, there is no firm high priority program for development of a powerplant-variant combustion engine suitable for the W.121A in United States.

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Now available for aircraft applications is a new type of rotary-positive displacement compressor offering these advantages:

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Washington Roundup

AEC and Nuclear Rockets

Atomic Energy Commission's brief announcement that its Los Alamos Laboratory is "concerned with research and development of nuclear rocket propulsion" has been followed by much speculation, little fact. Disclosure that the laboratory's N Division, headed by Dr. Rainer Schermer, has been working on the problem for the last year, brought out additional information that the Lawrence Livermore Laboratory also is concerned with nuclear powered rockets. Both are operated by the University of California on contract to AEC. One AEC spokesman and the project still is in the feasibility study stage. There were indications, however, that work was well progressed so far in the development stage. Although on one would say so, the Air Force has close liaison with AEC on nuclear rocket propulsion work.

The announcement was somewhat a surprising effort. The AEC and its purpose was to lead scientific and engineering know-how work. The private sector still was long on the employment of no engineers, William F. Carlson, of Boeing, Co. AEC Chairman Lewis H. Brown recently announced establishment of a new program to assist colleges and universities in training nuclear engineers, scientists and technicians. One provides for grants of up to \$750,000 to run one institution for acquisition of equipment, the other for loans of certain nuclear materials and by products, some of a fee and some at 20% of list price.

More Authority for CAA

The Civil Aeronautics Board and Civil Aeronautics Administration are launching a joint study of aviation as an industry to find out whether some of CAA's regulatory authority should be shifted to the FAA. CAA feels that in some regulatory fields, it would be a more effective role under terms of its more extensive contact with the problem involved.

The CAA held discussions early this month with representatives of the airlines, the pilots, plane, construction and the FAA to study air traffic regulation. Further discussions will be held in an effort to find solutions for air traffic problems.

'Reasonable Probability'

Comment of Dr. Clifford C. Fennel, Assistant Secretary of Defense for Research and Development, on the official satellite design, a talk before the American Institute of Chemical Engineers.

The well-publicized scientific article, which has a reasonable probability (though not necessarily a true basis) of success in the most important aspect of the program of the International Geophysical Year.

Soviet Talent Production

Adding statistics on Soviet training of technical specialists including scientists, engineers, agriculturalists and doctors. "Our best information indicates that the Soviets are producing these specialists at a rate not only greater than our own, but also greater than that of all NATO countries combined. For example, during the next five years we estimate that Soviet engineering higher educational establishments will graduate about 120,000

people—about twice our rate."—Air Force Chief of Staff Gen. Nathan Twining. Gen. Twining illustrated the problem with the example, "The Soviet International Business Machines estimates that 7,500 mathematicians will be needed to run computers on order, of which about 1,500 should be Ph.D.s. Here is our output: About 250 Ph.D.s a year will graduate this year."

Tighter Airways Control?

House Commerce Subcommittee on Aviation, headed by Rep. G. W. Hefner (D-Calif.), is pushing for tighter control of scheduled airline traffic. "We are going to have more screen—even if the airlines don't want it," Hefner said last week during the recent subcommittee hearings. "We are going to review the screen and request the airlines to fit in the screen."

James P. Kline, subcommittee administrator, and Oscar B. Bickel, deputy director of the Civil Aeronautics Board's Bureau of Safety Regulation, agreed in favor of the present CAA and CAB policy of less and usual flight in accordance with the subcommittee's report. "We will be more in the program of the day, Bickel testified. He repeated that there is a rule "a very, very small percentage of aircraft under positive control is present." In line with its program for positive control of fast and high flying jets, P. Kline pointed out that the CAA will have control over traffic above 24,000 ft. by April, 1975, and traffic above 15,000 ft. by Feb. 1975.

Commerce members, however, were not satisfied. Hefner observed that there has been no change in flight rules and regulations for 15 years, and that the only scheduled change came in a result of the conflict over instrument landing system (ILS) versus ground control approach (GCA) in 1947. He added:

"We must wake up to the fact that you can't drive a Cadillac under the same rules that apply to a home and heavy. There isn't a law of physics that says when there is going to be a jet flying through it."

Subcommittee members maintained that there is a possibility that the Grand Gateway collision between TWA and United Air Lines mid-air on June 30 night has been avoided if the United plane had been guided by CAA ground personnel as in the location of the TWA aircraft. The TWA aircraft was notified of the location of the United plane through the TWA office when it requested a change in flight course.

The CAA and CAB also were criticized by subcommittee for failing to take action basing the practice of concerned airlines of flying low over the Grand Gateway area for night-sighting purposes. Bickel commented that this practice is one of the possibilities that might have happened in the Grand Gateway crash.

ALPA vs. USAF

Air Force Secretary Donald Quarles has agreed to review the pay and cost of a recent USAF directive calling for removal of jet service personnel from the Air Force and Air National Guard route reserve (AW Sept. 3, p. 18). Most senior officials, however, held little hope that a solution available to the Air Force Personnel Association, which is the directive, would be reached. A conference held in Washington last week, brought the issue to a satisfactory conclusion.

—Washington Staff



FRENCH AIR FORCE Sikorsky S-55 helicopters ferry between two offices at Air Force base at Bouadja.

Special Report from Algeria, Part I:

French Meet Guerrillas With Helicopters

By Robert Farwell

Algeria—Troop-carrying helicopters—Sikorsky S-55s and S-58s, Vertol H-21s and Bell 47Gs—are being more than a third of the 700 missions French air forces average weekly in the Algerian campaign.

Bell 47s and Sikorsky S-55s are doing a fine job for the French, but recent additional orders for 40 Vertol H-21s and 130 Sikorsky S-58s under cover the interior of the French in their light types. French Dickie Miro, who is supposed to have put forward that it went ahead with the order despite the difficulties in finding the money and disapproval of the French Air Force and Army, over which type is best suited to the campaign.

Piston Planes

Something with the rebels has brought little need for an equipment, which is too costly to use against an enemy which rarely appears in numbers. Besides, many bases in Algeria have not been made to handle jet fighters.

Most jet fighters are in operation.

But of the 120 light fighters the French expect to have in operation by year end, a sizable proportion will be North American F-6 trainers, generally modified to carry four machine guns and six rockets in underwing racks. French use the T-6 to teach, ideal for their operational needs.

Less than 10% of aerial attacks have been direct strikes and bombing attacks against the rebels. However, the French Air Force will change this percentage when current operations start ages are eased. Main job of the French Air Force has been troop-carrying, border patrol (its previous specialty), scouting the rebels, observation, and evacuation of wounded.

French Air Force has adapted itself completely to ground force requirements, and as headquarters at Alger coordinates but does not initiate missions. Ground forces have three divisional headquarters. One, Alger and Constantine. Two with divisions attached.

• Mistral or F-47 tactical air group.

The 18-motor Republic fighters have suffered operationally, as typ-

ified by one squadron that lost a storm during summer operations north because of engine failure. "The only thing wrong with the F-47," the squadron leader said, "is its 14-cylinder." Negotiations are under way to obtain Douglas AD Skyraiders from the United States, with China, Vought F4U Corsairs, or second choice.

• Nocturne, G-47 or Douglas cargo transport plane, adapted to a transport group.

On most are broken down into 18 subdivisions where aerial operations generally are controlled. These units are assigned, besides helicopters and 1-6.

• SIFA and Mustang light transport fighters.

• Bombardier observation transport craft. But the French campaign seems to be strongest on helicopters, for which soldiers, placed at home and abroad, have reached close to 600. Included are 100 H-21s and 220 S-58s.

U. S. Designed

Helicopters, previously being used in Algeria are U.S.-designed, though all

the Bell 47s and some S-55s are designed locally. Actually, extensive troop-carrying operations by helicopters only began in earnest last spring. The H-21s and S-58s just began operating this summer.

French Air Force and Army groups are operating in Algeria a fleet of only 90 helicopters, including 11 H-21s and some S-58s. In addition, the French Navy, working with the Army, is mounting two H-21s.

The recall figure reflects losses due to accidents which reportedly involve a dozen ships, including two H-21s and one S-58. In some cases the ship was not actually washed out.

The main reason at the moment centers on the H-21 and the S-58, and these are in considerable repair shops during much of July and through into August.

The command helicopter operations, the first time such a nation has ever been, and generally, an armed unit, allow a rapid response to a ground force commander for aid in clearing out an area where a rebel band has been spotted. Ships are assigned to the mission, usually in groups of three, and fly about 50 to 75 mi to the pick-up point. The point, whenever possible, is located near a fuel dump—of which there are scores scattered along the frontier—in that

the helicopters will have full time for the mission.

Troop loading takes place quickly, the number carried, ranging from eight to fifteen, varies often depends more on the temperature and altitude than on whether the ship is an H-21 or an S-58.

Once troops are loaded the missions get under way. The helicopter gets into, flies at an altitude of 10 or only, but over exhausting territory that would take troops all day to cross or climb. When the drop zone is reached the helicopters enter lands and let off the troops at the location while the command ship stays. Very often the drop zone is an extremely small area, in that case, the helicopter stays up until their feet are on ground. Having the spot of air to test ships is not unusual.

Once unloaded, the helicopter flies back to the pick-up point and returns again, leaving it up until all the troops have been placed in position.

Strong Response

In the operations the French have taken much of the sting out of the rebel tactics, plus giving a heavier down mode bent to their own troops. Before the use of heavy helicopters, rebel bands would pick a fight at will with French troops by surprise attacks

'Les Perceps'

The French call them "Les Perceps" and they have proved superior to all other light observation units against the Algerian campaign. These are the Piper Cubs, operated by the members of the Air Force by the French Army, and being used in increasing numbers.

Pipers have done excellent "snare duty." Rebel bands had been successful in snatching soldiers captured moving over mountain trails, but the French found that if they flew over an assumed Piper Cub over the troops the rebels stayed under cover.

in mountainous areas. Their damage done, the rebels would break off the engagement and retreat up the mountain slopes and pass where the French found it almost impossible to follow. Now, shortly after a battle begins, the French scout troops around the rebel positions so that when the rebels try to retreat into the mountains they run into waiting commandos, fresh for battle.

Helicopters try to stay clear of the actual combat area. This isn't always easy, to do which a who, who, are pulled with heat. Once a tank is over, the wounded are embarked and



ARMY'S VERTOL H-21 seen in Algerian Mountains, again below landing. Army and Air Force differ over merits of H-21, S-58.



HOLLAND GRAY, now powered by 4,000-hp. diesel Bristol Orpheus engine, gives striking demonstration of the SBAC show.

British Air Industry Shows Wares at Farnborough



RIGHT SIDE view of Bristol Orpheus BOC 6 engine rated at 35,000-hp. thrust.



ROLLS-ROYCE Avon RA 29 engine is destined for Capital Airlines Gemini 4A.

Explosion at the 17th Empire of the South at Farnborough was no other than that of a rocket motor. The 1000-lb. rocket motor that exploded had a diameter of 10 in. and a length of 11 ft. 6 in. (the length of the rocket motor is 11 ft. 6 in.).

Specimens of the Avon RA 29, which will power Capital Airlines Gemini 4A, appear in the 1000-lb. rocket motor that exploded had a diameter of 10 in. and a length of 11 ft. 6 in. (the length of the rocket motor is 11 ft. 6 in.).

Little was in the way of expensive fighters was shown, but the Vulcan, the Conquest, and built as a private venture, put on a high display. Flight tests of the second series Conquest are expected to begin this fall.

Parry, Fairchild appeared on both sides of the Atlantic, but is not as well known as on either. Super Sparke rockets, that have been developed by the Fairchild, Vulcan, and Conquest, are the only rockets that have been developed by the Fairchild, Vulcan, and Conquest.



PROTOTYPE Vickers Supermarine Swift Mk. 7 is shown, fitted with two F4U Corsair air-to-air missiles.



ROLLS-ROYCE Avon RA 29 engine will be installed in the tail of a British Aerospace F 4A. 6 engines. Other jets are on each side of the fuselage.



AVRO LINCOLN is too big for Rolls-Royce Tyne turboprop engine.



VICKERS VALIANT bomber takes off on test with the aid of two de Havilland Super Sparke rocket engines (NW Aug. 20, p. 54).



PARTY of Soviet air officials, headed by the Minister of Aircraft Production, Pyotr Vladimirovich Zhukovskiy (center, wearing hat), visits the SRAC plant at Farnborough. Soviet jet transport plane is in background.

Britain Opens Curtain for Soviets

Farnborough, Hants, England—Russian delegates visiting Britain for the SRAC flying display in cooperation for Royal Air Force and Soviet industry groups that visited the Soviet Union last summer, say, for more here than western visitors was shown at Farnborough.

The Russians at the Tushino air show viewed only quick glimpses of military aircraft in flight and ground inspection from moving cars. At the SRAC show, Russian visitors were permitted close and lengthy inspection of British military and transport aircraft on the ground in addition to the flight performances.

Commander of the Red air force flying training command, Lt. Gen. Alexei Ilyushin, was permitted to fly a Hawker Hunter two-seater trainer when he asked to do so. He was taken up by British pilots, chief test pilot William Bedford for two flights. On the second the Russian general made a supersonic dive and a landing.

This performance was particularly interesting to the British pilots who have been barred from making flights to the Hunter trainer for security reasons.

The two-seater trainer has a low-power jet Rolls Royce Avon engine that the Mark 5 fighter now going to the Royal Air Force.

The Russian second another fast

when they saw the Armstrong Siddeley production line for Supersonic Turbojet engines. This is a much higher power and more engine than the Russian jet engine flew jet engine shown next winter during a plant tour in Moscow last summer. The Russians also visited the Speer engine plant and the National Physical Research Laboratory in addition to four Royal Air Force stations.

Aerophysics Develops Hypersonic Rockets

Washington—Development of the first of a family of hypersonic research rockets was announced last week by the Air Force and the Air Research and Development Command.

Initiation of the hypersonic test vehicle (HTV) was approved by Air Force on April 25 (p. 31).

Twelve experimental models of the pre-stage, and propellant rocket have been fired at ARDC's Holloman Air Development Center. The HTV, now under development, has developed by Aerophysics Development Corp., a subsidiary of Curtiss-Wright Corp., in conjunction with ARDC's Wright Air Development Center.

Booster stage of the HTV consists of seven rockets with three fins. The second stage consists of four rockets

and four fins (NAV Sept. 10, p. 32). Each stage is 5 ft long. The booster is 9 in. in diameter, and the second stage is 6 in.

A two-foot nose cone contains a magnetic tape recorder that charts rocket acceleration and nose cone temperature and pressure.

Nose cone configuration, dimensions and composition may be changed, and the effects of the change studied in relation to hypersonic flight, giving data on aerodynamic shapes, aerodynamic heating, rocket stability, and pressure distribution, according to ARDC.

HTVs are fired from a 15-ft portable launcher. All seven booster rockets are ignited simultaneously. Separation ignites the four second stage rockets. A special sound system that of sound is recorded ten seconds after launch. Ten seconds after burn out, three laminated glass fiber fins are blown off the second stage by small charges within the rocket and the main body and nose cone tumble to earth in a flat spin at about 100 mph.

HTVs are expected to test about 55,000 each. Work on the 50 million contract began in 1953. First flight was in November, 1954.

Dr. Robert H. Mink, chief of the fluid dynamics research branch of WADC's Aeronautical Research Laboratory, is directing the research. Kenneth F. Stinson and Lt. John H. Lane are WADC task controllers on the project. (Picture of Aerophysics hypersonic test vehicle appears on page 116.)

"One Sword Keeps Another In The Sheath"

George Herbert



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Crowds Drawn by Air Show Save Canadian Event From Extinction

By Alpheus W. Jenne

Toronto—U. S. Navy's Blue Angels flying formation F-4 Phantom and a French test pilot in the Fouga Magister 170 light jet trainer stole the show at Canada's Third International Air Show.

Held in conjunction with the Canadian National Exhibition for the first time, the air show was viewed by nearly 400,000. Prior to the last two days, exhibition attendance was off 30,000. Largely due to the air show, the last two days' crowds rose and made up the decrease and set a new record for the two week exhibition.

The second half of the year probably saved the Canadian International Air Show from extinction and ensured its development as a permanent fixture of the exhibition. In previous years the air show had been held in conjunction with the Toronto International Trade Fair, a government project canceled in this year's national budget. In affiliation with the exhibition was in the nature of a host.

Limited to Flying

However, the exhibition had already decided all exhibit space before the exhibition. Thus there was no room for static exhibits. Thus the air show was limited to flying displays.

Plans are already being laid to allocate more space at several fairs for the exhibits at next year's exhibition if at all. Exhibit space will be available to foreign as well as Canadian visitors.

More exhibition plans have been made for a permanent aviation wing. Air show officials hope the exhibition management will be able to coordinate it as early as the 1958 show.

Besides the interest, both the Canadian aircraft industry and the aviation service are expected to receive their share. The Aircraft Industry and Inflight Association, representing aviation manufacturers and airlines has found a major role in the air show is, without more, have secured air show officers that they are prepared to take a more active part.

Top staff officers of the Royal Canadian Air Force are now preparing to get on a more dramatic display. They felt that the U. S. demonstrated this year's air show. In particular, they were charged with having the U. S. Navy put on the "divinely best show in the currently best spot on the schedule"—the concluding act by the Blue Angels aerobatic team.

Most important in both AITA and the RCAP is the need to sell aerospace hardware.

That air money rankings in the Canadian government in part fostered in the Canadian sense, against development of a Canadian aircraft industry and against putting a more share of the defense dollar into the RCAP. Development of an air show will not offset the threat through its demonstration of aerospace to the Canadian public.

Next Year: CF-105

Next year's air show was the high lighted by the first public display of Aero Canada's 1,200 mph CF-105 all weather fighter. The first aircraft is scheduled for roll-out sometime next year. Approximately 17,000 of the nearly 30,000 parts of the all-weather fighter have been manufactured.

RAAF's Hunter Hawks, awarded from this year's show because of the Star Canada has been promised for next year's program. Future experts to seek a larger representation of aircraft and equipment. Today has indicated that it would like to bring over its B-57 Super Scorpion team. What Canada plans some representation.

Besides the Blue Angels aerobatic demonstration and the flying display of the Fouga Magister trainer, highlights of the year's Canadian International Air Show included:

- Demonstration of the de Havilland Beaver and other amphibious light transports. The 1,600th Beaver is now on the production line and de Havilland's backlog is about 200 aircraft. North 100 Otters have been built with at least another 160 firms scheduled.
- Record flight of four U. S. Navy

F-4s from Chicago to Toronto in 39 min. Average speed 743 mph.

• Flight of an RCAP CF-105 all weather fighter from Toronto, Newfoundland, to Toronto in 3 hr. 5 min. The distance is 1,394 mi.

• Major showing of the Royal Canadian Navy's newly acquired McDonnell-Bueller 41's carrier fighters.

Other fly-outs were made by RCAP's T-33s, T-38s, CF-105s, CF-104s, and Constellation P-1's. RCAP's Constellation C-52B, USAF's F-80Ds, B-36, KC-97, including a B-57, F-54G, and F-80B.

In a single take were several new aircraft: Aero Commander 680 de Havilland Hornet, Royal Gull and Gemini 310 and 162.

News Digest

More than a third of Navy's Douglas F-4B's B-57's are scheduled for take-off in the next few weeks of a delicate atmosphere involving flying, were flying again at the end of last week. All should be back in service by end of next week.

Monroe Saboteur MS 760. Para prototype completed first part of test for American Certificate of Acceptance. Second prototype now in going through ground tests for the next phase.

Martin TM-41 Matador effectiveness will be measured in modification program. Air Force contract for work worth \$4 million. New wing of three Matador groups is expected to go into operation in Europe this month.

USAF Aircrew & Air Communications Service will absorb USAF's Light Services. Get 1. Communications of all airways guiding operations under no command will now \$250,000 annually.

Lockheed F-107 Neptunes will be fitted with 18-ft. high, 3-ft. wide, steel end of composite aluminum alloy, and staff the service with General Dynamics F-105s in the Air Force. The four aircraft will have number six attached to name ahead of it. It is larger also mounted on main gun.

Aero Valves handles powered by four Bristol Olympus turbo-propellers 14,144 sq. in. from Bristol to Australia in 27 min. First time, a single engine 500 mph. Two jets were made. Allen and Singapore South after Vulcan left Allen. Resumes ground tests, looking out communications over Indian Ocean around Britain.

Russians Absent

Russians did not appear at the Canadian International Air Show, despite the interest that they expressed to Edgar Albert, president of the Toronto Flying Club, at the Toronto 6 by (ATF) Feb. 2, p. 20.

In fact there wasn't a message from the Soviet Union about the Toronto show. The Russians are reported to have replied to Canada Ministry of External Affairs for permission to be represented at a display in some other Canadian city in October. No display is scheduled for the time and place mentioned. Without explanation, Canada turned down the request.

Special IATA Meeting Report

Jet Orders Demand Airline Sales Push

Director General takes calm view of capacity implications but emphasizes breadth of increase.

By Robert Blatz

Edinburgh, Scotland—International airlines want to go all out for the main transportation market of this age, to enter the coming jet age successfully. Sir William Hildred, director general, told the opening session of the fourth annual general meeting of the International Air Transport Association here.

He warned airlines that the fleet of jet transports that have no order will exceed the present capacity of IATA members 7,700-plus fleet is a wide margin and they must be able to cope with the new era.

Mr. Williams told IATA members that his forecast of future capacity in 1970 looks like that, but he says the prospects of disaster will fade that airlines have bought new capacity far beyond any foreseeable traffic rise and the optimism will look for a rapidly changing in 1960 and not rising that load factors will be rising noticeably high by then.

"The airlines have to begin now the hard work which will be necessary to make that forecast possible," he said. "One very important aspect of this work will be to increase the flow of new orders to fill the new aircraft and keep the other types of aircraft busy for as long as they are required. Airlines must find out how to get out for the new aircraft and move them to governments a few years down to the latest level consistent with second economic objectives."

Other Major Requirements

Among other major requirements for the jet age along with proper fire protection, Sir Williams noted:

- **Scheduling.** Control of air travel in the future will depend on large increases in efficient utilization of jet transport fleets. This means airline travel must be made into round the clock operation, with night arrivals and departures accepted as normal procedure.

Second, transportation to and from terminals, availability of hotel facilities and ticket and information services at any time of day or night.

- **Navigation facilities.** Old concepts of air navigation, traffic control and so on, are being replaced by new concepts. High speed transports. He noted the aircraft would need ICAO navigation plan for the Caribbean region as a step in the right direction. This calls for specifying larger airports as central areas where, high speed aircraft would be required to transfer control area for low-speed, short-range traffic.

"This is the type of transfer handling of the routes involved in going beyond national boundaries and national passage which will become central in future planning of air traffic control outside an air traffic region," Sir Williams said. "Also to the standard and controlled designation of airspace boundaries is the even more important political question of whether control is to be a political expedient while control is to be a different order than the responsibility for controlling aircraft in the new space. The only practical solution, naturally, is to establish a single center controlling the whole area and this must come from a position that technical and operational considerations must take precedence over national prestige."

- **Ground handling.** Something has been wrong in the coordination between those responsible for planning airport facilities and the airlines who want to use them, according to Sir Williams. This has meant the ground handling chaos that exists today and adds enormous time to air travel. He warned that the very real necessities of ground handling procedures necessary for the jet age will come only from developing national facilities and trusts that are in modern and efficient as the jet transports they will have to use.

Utilization of the current type of piston engine transports after jet because of economic reasons is a serious threat and economic problem the airlines will face. Sir Williams also noted two great unknown factors in airline activity regarding the economy of the jet transport era:

- **Existing restrictions of travel** from Europe to America. He warned that income must be found to make the transatlantic route into a two-way street.

- **Influence of fare structure on traffic volume.** He said that some airlines are in trouble because they are not possible through small and frequent refueling on average fares per passenger mile, but only through more substantial, at less frequent, changes in the fare fare structure and fare level.

Airline Achievements

Reviewing the economic health of international airlines, Sir Williams noted the following achievements during 1955:

- **Passenger traffic** showed an increase of 19% over 1954, with 65 million passengers carried. 41 billion passenger kilometers. Cargo showed a 16.1% increase to 1.3 billion tons/kilometers in contrast to increases before 1955 for the past three years. Mail increased only 1.4% compared with 1954 during 1955. Despite all this, the year ending March 1955 was the North Atlantic where over 700,000 people were carried for a 19% increase over 1954.

Sir Williams said figures for such months as 1956, which showed a 19% increase of this increase and the forecast early attainment of a goal of carrying a million passengers a year across the Atlantic and expanding the carrier atmosphere to include all the world.

- **Revenue of airlines** rose to \$1 billion in 1955, an increase of 18% over 1954. About \$2.5 billion or 78% of the total was accounted for by passenger traffic. Cargo brought in \$1.15 billion and Mail was \$75-\$820 million dollars.
- **Operating profit** rose only \$1 million, reaching \$15 million for 1955. These figures reflect a new method of competition, showing money received in government subsidies. Figure for profits was raised by the concept shown a \$10 million operating profit for 1954, a \$35 million loss for 1952, a \$1 million loss for 1953, and a \$32 million operating profit for 1954.

Sir Williams noted that primary profits of the airline business would be from operating in the domestic field and that international airlines were a long way from breaking even. An airline he cited a \$2 million loss of 18 international airlines for 1954 on total revenue of \$1 billion.

Reply to Critics

Sir Williams lashed out at critics of IATA who have taken issue with IATA policies. Although not mentioned by name, he began by saying that criticism of the Civil Aeronautics Board and the Congressional Subcommittee headed by Rep. Emanuel Celler, (D-N.Y.), who has charged that IATA

is an international cartel. "It must be pointed to the danger of such charges," he said. "IATA is not a cartel and the international air transport industry is not made and could not be established for that kind of control," he said. "No single group of airlines industry could be based in the standpoint of international monopoly, working under arrangements that are designed to keep down output and keep up prices. The main commodity whose price has come

down steadily during the past 10 years is the airline ticket."

He warned who wanted against their attempts of the Universal Postal Union to cut air mail parcels to achieve its program in Ottawa, that the industry is long having pressure on these governments to float the congress to give right on air mail parcels or "any way an air mail commodity to a lot of other millions of dollars."

ATC System Forces Change in Passenger Ticket Buying Habits

By Gloria Gerson

New York—Most of the nation's domestic airline passengers will have to change their ticket buying habits under the industry's new fare book plan going into effect this week. One major cost element, that is, the passenger benefits between their tickets and the airport shortly before their departure period.

The new Air Traffic Conference sponsored plan—effective this week—will require that every passenger (with a few exceptions) has to travel at least an hour before departure in order to hold his reservation.

Most of this first phase of the new program, which is being phased in, will be in the ATC prescribed details beyond which the carrier has agreed not to go in holding reservations. But the long, this deadline may mean the change in former reservation procedure. It sets 12:01 p.m. on the day of departure or an hour in advance of departure, whichever is earlier, as the minimum time limit for ticket purchase. Tickets made before noon on the last business day before departure.

Most carriers will continue the practice of negotiating purchase deadlines with their customers. Following guidelines set on a system-wide or local basis. All important difference is that negotiable in advance of noon now comes at the airline's discretion.

Second Phase

Most airline officials expect the second and more stringent phase of the program, which provides for late cancellations or no-shows, to be implemented on schedule Feb. 1. Adoption requires 1955 agreement by the carriers at a meeting in December, plus Civil Aeronautics Board approval.

The industry seems confident that few difficulties will be met in working under the new rules, but the first three months are seen as a shakedown period during which public reaction to the

deadline enforcement may be evaluated, and procedural details changed when necessary.

A few airlines will operate with stricter deadlines than required by the ATC minimum. Examples:

- **American Airlines** has set 5 p.m. on the day before departure as the final purchase deadline for its domestic routes before noon of that day. American will adhere to the 6 p.m. time limit generally, but can make exceptions up to the ATC minimum. Restrictions made after 5 p.m. for the day before departure are not subject to the ATC requirement, but American will seek to negotiate a time limit two hours or more before departure in these cases.

- **Eastern Air Lines** previously had set and generally enforced, time limits, over about 90% of its routes (and no exceptions). Flights to and from Atlanta City. These varying deadlines will be continued, but exceptions beyond the ATC minimums as kept will be made.

Non-carriers, however, since fare has previously enforced a requirement that tickets be picked up within 48 hours after reservation is made if time permits. The arrangement will continue.

Travel agencies will continue to follow pickup set up by their companies when negotiating purchase on reservations made well in advance. Starting point for the new ticket commitment here for the customer.

Among the Big Four, American was to waive pickup within three days after confirmation as a concession made more than two years before departure. American will pick up tickets before departure when the reservation is made earlier than that time; at within two weeks, pickup at a convenient time the time day is decided. In the case of Western Airlines, the time limit may be decided at the desired level. United Airlines wants tickets picked up a week before departure as a concession. United and TWA are not



Bristol 173 Tail Change

Bristol 173 helicopter displayed at Society of British Aeronautical Contractors' show at Farnborough carried international airlines and control from various configurations like Beechcraft Bonanza.

A SATISFIED CUSTOMER FOR THIRTY YEARS



Mrs. Redington's 1955 airline ticket.



Thirty years have brought radical changes in Air France equipment, but not in its reputation for dependability and comfort aloft.

Ask Mrs. Charles Redington of Lenoirville, Pa. In the picture above she is one of the group boarding a Fataren "Goliath" in France prior to her flight to London. The date was July 4, 1936.

Now 34 years later, Mrs. Redington will once again be an Air France passenger. This month she will be one of a group like those in the picture below boarding a giant Air France Super "G" Constellation enroute from New York to Paris.

Air France is proud of Mrs. Redington's continued preference for its services. She is typical of those who have helped make Air France America's favorite European airline.



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Airline Traffic—July 1956

	Revenue Passenger-Miles	Revenue Passenger-Miles (1955)	Load Factor	U. S. Mail	Express	Freight	Total Revenue Per-Mile	Per-Cent Increase in Revenue Per-Mile
DOMESTIC TRAFFIC								
American	436,418	429,338	66.9%	1,470,716	726,911	8,428,741	\$6,627,320	26.1%
Boeing	194,387	215,443	55.9%	298,489	171,846	3,324,116	\$5,626,796	48.1%
Continental	328,234	311,810	59.7%	297,384	158,446	8,479,174	\$6,461,61	46.6%
Delta	26,276	27,229	30.6%	48,326	26,272	1,011,401	\$2,362,108	44.1%
Eastern	150,444	157,436	60.3%	276,480	226,375	3,228,617	\$5,444,201	21.2%
Northwest	446,418	471,741	67.9%	1,009,475	579,437	1,868,475	\$4,468,466	44.4%
Southwest	105,477	110,160	66.7%	213,410	99,470	969,379	\$7,731,733	44.2%
Texas World	46,323	47,128	66.7%	112,138	10,420	31,727	\$5,227,027	33.7%
Trans World	176,126	180,416	61.4%	379,276	180,370	642,412	\$3,663,466	32.6%
United	306,479	291,076	67.7%	567,311	429,237	1,448,707	\$1,941,814	46.1%
Western	246,740	261,352	66.6%	770,745	771,247	1,257,207	\$4,744,207	36.4%
Worland	97,374	92,810	69.4%	226,728	70,427	100,261	\$2,666,698	32.4%
INTERNATIONAL								
American	12,372	8,328	47.7%	11,362	876	213,420	\$1,264,880	40.9%
Boeing	3,076	4,377	44.3%	50,873	176	71,709	\$6,412,27	37.1%
Continental	1,027	1,167	59.7%	1,027	69	1,176	\$1,687,406	41.9%
Delta	3,274	2,488	40.9%	6,111	36	36,151	\$3,831,895	44.2%
Eastern	26,100	40,370	77.3%	46,237	73,700	1,533,103	\$4,207,27	49.2%
Northwest	12,356	8,178	66.7%	8,991	4,491	37,110	\$2,744,466	47.9%
Southwest	11,444	10,250	66.3%	446,301	91,260	770,441	\$4,947,160	71.4%
Texas World	8,127	8,337	70.4%	29,436	484,305	1,633,326	\$1,633,326	61.4%
Trans World	107,427	136,169	64.4%	948,121	1,729,382	16,404,467	\$2,834,467	27.6%
United	79,496	918	76.4%	1,014,445	1,264,371	16,493,479	\$1,548,479	71.4%
Western	133,480	121,300	77.3%	324,139	1,264,371	14,433,426	\$6,437,426	60.7%
Worland	12,327	13,014	66.7%	36,372	307,812	1,621,380	\$2,848,466	46.4%
Trans World	25,444	33,444	66.4%	407,444	773,425	8,479,444	\$4,479,444	47.4%
United	12,187	30,444	76.4%	19,444	35,427	5,476,444	\$2,476,444	76.4%
LOCAL SERVICE								
American	36,691	6,014	41.4%	6,441	12,441	3,447	\$60,446	61.7%
Boeing	11,414	5,444	41.4%	5,444	1,764	1,476	\$1,476	41.4%
Continental	8,005	8,321	31.3%	2,487	1,452	5,074	\$1,074,466	26.4%
Delta	17,447	6,441	30.4%	13,421	7,421	27,426	\$2,426,466	26.4%
Eastern	16,761	4,444	26.4%	1,444	18,411	1,411	\$1,411	26.4%
Northwest	27,110	4,920	49.4%	5,883	6,426	8,446	\$4,446	49.4%
Southwest	31,235	8,328	26.1%	18,231	32,761	7,426	\$4,761	41.1%
Texas World	26,481	6,014	41.4%	6,441	12,441	3,447	\$60,446	41.4%
United	16,327	6,014	41.4%	6,441	12,441	3,447	\$60,446	41.4%
Western	15,444	2,727	41.4%	2,727	15,444	3,447	\$1,447	41.4%
Worland	12,187	30,444	76.4%	19,444	35,427	5,476,444	\$2,476,444	76.4%
Trans World	12,187	30,444	76.4%	19,444	35,427	5,476,444	\$2,476,444	76.4%
NEW YORK								
American	42,444	6,444	41.4%	6,441	12,441	3,447	\$60,446	41.4%
Boeing	20,700	5,444	41.4%	5,444	1,764	1,476	\$1,476	41.4%
CANADIAN LINES								
American	7,273	26,714	99.3%	27,007	12,447	7,767	\$1,767	73.3%
Boeing	5,440	27,003	94.4%	21,003	42,003	2,612,003	\$2,612,003	74.4%
Delta	6,589	24,706	99.3%	24,706	1,114,388	4,444,427	\$4,444,427	99.4%
MELBOURNE								
New York Airways	2,467	49	63.4%	49	1,411	4,411	\$4,411	63.4%
Los Angeles Airways	1,411	49	63.4%	49	1,411	4,411	\$4,411	63.4%
Melbourne Air Service	2,467	49	63.4%	49	1,411	4,411	\$4,411	63.4%
ALABAMA								
American	7,206	2,717	37.7%	40,717	407,873	946,447	\$1,447	37.7%
Boeing	4,207	49	41.4%	4,207	4,207	4,207	\$4,207	41.4%
Continental	3,446	264	39.7%	3,446	212,268	331,718	\$1,718	40.3%
Delta	8,746	423	33.7%	3,423	3,423	3,423	\$3,423	33.7%
Northwest	14,566	11,204	67.1%	73,446	841,046	1,423,446	\$1,423,446	67.1%
Southwest	2,447	2,027	30.2%	30,024	1,379,173	8,446,446	\$4,446	94.4%

*Not available.

Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.



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a continent away
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computation

For some time, Burroughs has been participating in the U. S. Air Force Ballistic Missile program in the field of guidance. This program consists of two intercontinental ballistic missiles Atlas and Thor, plus an intermediate range missile, Titan.

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- Electronic Instrument Division, Philadelphia, Pennsylvania
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- The Ford Company, Inc., Rochester, N. Y.

Burroughs
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Looking to future expansion, Burroughs invites inquiries from qualified engineers.



SAS Staggers Seats

Staggered seats will be introduced in Southern Railway System DCTC North Atlantic Coastal Express flights this month and next month on Los Angeles to Copenhagen train paths. Design staggers into 41 in. from lower floor about straight line toward rear of car. Combined width of all seats is 7 ft., standard outdoor width 15 in., and from top of window to floor is 19 1/2 in.

CAB Revives C & S Rate Case

Washington—Civil Aeronautics Board has added a new twist to the scheduled rate, the CAB issued the possibility of reopening the international rate for the 1948-52 period. Now the Board has decided to reopen that aspect of the case for review, taking a final decision on it by the end of the year.

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The case arose in 1951, just before the CAB issued its decision on the international rate, but the CAB says the case is still open. The Board wants to review the case in light of actual experience rather than the fact that on which it was originally based.

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Ozark Recommended For Quad Cities Route

Washington—Civil Aeronautics Board has recommended that the Quad Cities route be operated by the Ozark Air Lines.

Ozark was found to operate a new route between Des Moines, Iowa, and Minneapolis-St. Paul, Minn., via Cedar Rapids, Iowa, and Rochester, Minn. The route was found to be the most economical and the most convenient for the public.

The CAB found that the route was the most economical and the most convenient for the public. The route was found to be the most economical and the most convenient for the public.

Bad Approach Blamed In Eastern Crash

Washington—Civil Aeronautics Board has decided that the Eastern Air Lines Constellation crashed at Jacksonville, Fla., last December because the pilot applied power for a missed approach too late to avoid ground obstructions.

The accident occurred on Dec. 21 when Eastern Air Lines Flight 642 was on final approach for a scheduled stop at Jacksonville. The pilot applied power for a missed approach too late to avoid ground obstructions.

The CAB found evidence that power had been applied just before the crash and that the pilot was too late to avoid ground obstructions. The CAB found evidence that power had been applied just before the crash and that the pilot was too late to avoid ground obstructions.

SHORTLINES

Reith European Airways will begin service to London and Paris via Rome, Italy, in 1954. The airline is owned by the Italian government and is based in Rome.



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ROLLS-ROYCE AERO ENGINES LEAD THE WORLD

Branches Frankfurt, Düsseldorf, Amsterdam, Zurich and Rome via Wiesbaden. BFA's capital on contract in Air France has been cut from 40% to 15%, but East Douglas, BFA's chairman, will remain as the board of directors of the last airline.

► **Belvia** has purchased eight B-37s for the use of the government and the Belvia Development Corp. The hardware will be manufactured in Belvia and used to transport food and other goods within the country.

► **Capital Airlines** inaugurated two new Vietnam flights last week between New York and Chicago. All four flights are nonstop scheduled for 7 to 10 a.m. Capital now has 15 Vietnam.

► **International Air Transport Assn.** has produced three new machine bids to be used for machine, possibly as single cargo after Oct. 1. The picture of bids are part of a standardized program now under way. New bids in marketing programs there are intended within this year.

► **Lufthansa** opens a new route to Tientsin this week and plans to extend the route to Tokyo by 1961.

► **Midwest Airlines** has inaugurated service to Glen Falls, N. Y., with two round trips daily connecting the city with Boston, Syracuse, Rochester, Buffalo and other northeastern points.

► **North Central Airlines** claims a local airline passenger record with 56,657 passengers loaded in August.

► **Singapore's** airport traffic increased 55% in the last half of the year and is expected to total more than 300,000 passengers for the full year.

► **Soviet Union** has asked permission for Aeroflot to fly over West Germany when it opens new routes to West European cities. Such permission must come from Britain, France and the United States under terms of the Götting peace treaty.

► **Swissair** is doubling the size of its New York reservations department to handle increased transatlantic traffic. Swissair carried 55,501 passengers in July, 1959 more than last year.

► **Tokyo International Airport** will be improved in a \$15.5 million government program designed to prepare the field for jet operations. A new 10,000 ft runway will be in operation by 1960 and present 5,000 ft runways will be lengthened 1,000 ft. Tokyo also will get new control tower equipment and parking facilities.

AIRLINE OBSERVER

► **Secore** will bring its transport Canaville airline to the U. S. about May 1 for a tour which may last two to three months. It will visit the main bases of all major airlines. The first three production airplanes will be delivered to Air France in 1959 and probably will be placed in passenger service on Air France routes in the Caribbean. By first time the French airline may have completed its arrangements for service out of Miami to its possessions in the area. New Canaville are scheduled for delivery in 1959. In 1960, Secore plans to turn out four aircraft per month. If orders are sufficient, it will double this output. Should the Canaville attract a large number of orders, Secore has arranged with Republic Aviation Corp. for the establishment of a second production line in the U. S. with a capacity of up to seven aircraft per month.

► **United, Northeast and Northwest Airlines** are reportedly interested in the Conquest 550 medium-range jet transport and at least one of the companies may place a sizable order within 60 days. Northwest's interest in the Bristol Britannia transport has not dimmed (AW Sept. 10, p. 47). George Gardner, the airline's president, called a special meeting of his key executives immediately after his return from an eight-day trip to England to allow them to criticize his "many impressions" of his visit with the British people which, he said, he found "interesting and enlightening." Gardner emphasized, however, that no commitments were made during the trip.

► **Conquest 600 jet transport** will sell for \$5,050,000 including reserve thrust and engine oiler. It 550 sales reach 250 annually, Conquest gives an average 100,000 seats to passengers that will bring the cost down to \$5 million.

► **Lockheed Aircraft** is launching a bid to expand the market for its 1049G, 10-1981 and 10-199A transports. Conquest's top sales officials are convinced there is a big potential for high-performance, piston-engine transports despite the coming of turboprops and turbojets.

► **Capital Airlines** estimates the Rolls-Royce Avon 39 turbojet engine powering the Conquest IV will have tipped one million orders by the time the first Conquest on Capital's order is delivered.

► **Two new turboprop transports** are under development in England. Aerobank White with his started work on two prototypes of a medium-sized, two-engine turboprop for continental Europe, and Aerobank and British Airlines is developing a 40 passenger turboprop version of the Twin Princess.

► **Aerobank Airlines** and British Air Transport, civil domestic operators in Australia, are planning a merger that will bring an end to the one-year-old war (AW Sept. 5, p. 47). It is understood that the proposed merger is strongly opposed by Australian National Airways. ANA already a large stockholder in British now ask a majority voting right by buying more shares in hopes of killing merger negotiations.

► **An Traffic Control Assn.**, representing approximately 2,000 controllers, has challenged the Civil Aeronautics Administration to deny or confirm a Civil Service Commission statement by chairman Philip Young that the CAA has agreed to a CSC program on controller standards that will result in the deregulation of some personnel (AW Aug. 27, p. 38). ATCA says its main aim was to be to be that the CAA had approved the standards which formerly were set by effect Sept. 1. No action has been taken, however, pending CAA-CSC review.

► **Acting Civil Aeronautics Administrator James Pyle** has announced his intention of continuing policies and programs of the late Charles Lorenz without change. Lorenz died on Sept. 5 (AW Sept. 10, p. 43).

► **Two Civil Aeronautics Administration officials** are in Europe to study protection and technical matters with the Lowcost Co. of Germany. Mutualization of VOR units that will be enabled on international routes under the protection of International Cooperation Administration.

Vital accessories for the fastest fighters



AFTERBURNER ACTUATORS—the Lockheed F-104 Starfighter, world's fastest fighter plane, has four AeroProducts systems on the afterburner for action as fast as its 170 engine. Designed for extremely high temperature operation, these hydraulic actuators are synchronized to coordinate in perfect motion, providing vector, positive

control of the afterburner nozzles. This patented feature of mechanical synchronization provides precise positioning by insuring positive nozzle shifting within the hydraulic tubing to coordinate the linear travel of the nozzles precisely. Another safety feature is a stroke limiter which prevents the tail cone from closing completely in the event of hydraulic failure.



WING INCIDENCE ACTUATORS—the Chance Vought F4U Corsair, world's fastest Navy fighter plane, showing its unique two position incidence wing as "up" position for take-off, low angles normal flight position. First operational plane to incorporate this principle, the F4U has

an AeroProducts self locking hydraulic actuator which controls the angle of attack of the wing. Changing the wing angle permits the Corsair to land level with the runway and gives the pilot better visibility and permitting use of shorter, lighter landing gear.



RAM AIR-DRIVEN GENERATORS—on the Douglas A-1D Skybolt—AeroProducts emergency air-driven generator is first production application of ram air driven equipment. Suspended beneath the fuselage, this turboelectric unit (12 lbs.) gets up to speed at less than 1/100 second and develops 1.7 KVA @11,000 R.P.M. to operate radio, lights, instruments, bleed air and elevators. It has successfully

performed in emergencies and has been dropped and entry tests on field tests. Using a simple blade pitch changing mechanism, the unit governs its output frequency within plus 10% and minus 5% over a very wide range of airspeed, altitude and load conditions. This unit also has application in low speeds to generate power for starting mechanisms.



AIR-DRIVEN HYDRAULIC PUMP—the North American F-100 Super Sabre is equipped with an AeroProducts air-driven hydraulic pump which provides sufficient hydraulic pressure for flight controls in case of engine

or hydraulic failure. This lightweight ram air pump is mounted back of the cockpit, where air from engine or inlet ducts can be directed by the pilot to drive the turbine pump in emergencies.

Precision is the keynote of our work at AeroProducts. Turbo-propellers and other essential aircraft components are produced by engineers experienced in designing equipment to meet specific requirements of our customers.

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Cameras Track Crusader

Clusier X-15U Crusader, ready for takeoff on ramp at Naval Ordnance Test Station, China Lake, Calif. (top) visited by two Beeve cameras (bottom right) at southern end of course for Thompson speed run. One of eight Actuator cameras (bottom left), here mounted on helicopter, caught the X-15U (right) in the 1,600-Mph. run. Aircraft, even from inside make instant measurement possible.



AERONAUTICAL ENGINEERING

Republic Turns to Dual Actuator Controls

By Robert H. Carlson

Pasadena, N. Y.—Republic Aviation is retrofitting approximately 1,500 F-4H's with a simplified control actuator system and is planning to use an advanced version of this new system in its forthcoming F-105 fighter launcher.

The system is called a tandem actuator system because during normal operation it uses two independent hydraulic lines working side by side on the same control surfaces. Such movements cause both systems to act in unison to enable the control surfaces to respond.

Both halves are sized so that they are capable of carrying the primary control surface alone.

Automatic Safety

Advantage of this system from the pilot's viewpoint is that he doesn't have to do anything upon the failure of one of the systems since a stand-by system, in effect, is already in action and automatically in phase.

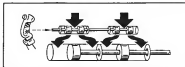
Advantage can also be derived from the fact that the two systems work in unison so that the other half would come into play if the other half should fail. In the event of a failure, the pilot could command the control surfaces to deflect without any appreciable loss of continuity.

The redesigning has been accomplished by putting both the main valves and the servo actuating system on the same shaft. This way an abrupt malfunctioning will stop. Other means of simplifying tandem systems are possible. For example, North American uses a tandem system without direct mechanical connection on its F-105, but the virtue of Republic's system is that mechanism is built in (as opposed to being retrofitted) and no further adjustment in the field is necessary.

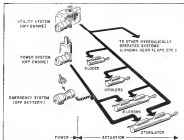
Simplicity Gained

"The most noticeable aspect of the tandem actuator system is its simplicity as compared to the original system," William E. Shugrue, Republic design safety engineer, said. "Approximately 52 components including valves, switches and relays have been eliminated in addition to numerous lines and fittings. This results in greatly simplified maintenance, greater reliability and ease of operation."

There is considerably less maintenance



Republic's new control system is built around tandem actuators for the main surfaces. These actuators are composed of two systems, each with a valve and piston, each with both main valves and pistons on the same shaft to insure continuous synchronization. Not only both sides are working, but each has the capacity to handle most of the load alone.



Two halves of the most important controls, rudder, elevator and ailerons, are powered by two independent hydraulic lines. One is the power system which is for the rudder, elevator and ailerons only. The other is fed from the airplane's ground utility system and feeds the rudder boost and the high speed roll spoilers as well.

on the tandem system, Republic Liaison Engineer Larry Levine observes, for there is very little to do except put the oil in.

Check-outs are positive; the system either works or it doesn't. There is a minimum of check-out and no adjustment to make. Instead, it is the pilot's judgment, as compared to the previous Republic system.

Rever of 125-135 lbs. weight used goes along with the simplicity.

All electric components have been eliminated except for the motor driving an emergency hydraulic pump and one

single throw on/off switch to energize the motor. Power and utility sources have been made completely independent, with each system supplying fluid to one half of the tandem actuators on the rudder and ailerons. Rudder and spoilers are operated by single oil lines connected to the utility system.

In the F-4H the rudder and ailerons are designated as primary controls—the rudder would be the the ailerons. The spoilers were added as an afterthought to increase high speed control roll rate. The pilot has no difficulty in using the rudder, spoiler

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Engineers concerned with the pumping of various aviation fluids know well the difficulties of getting good performance at high altitudes where low inlet pressures are encountered.

Pumps which work well at low altitudes frequently run into trouble when they encounter the frequent pressure changes, shock and turbulence which promote foaming and lowered efficiency at high altitudes.

Gerotone pumps are efficient at high altitudes and therefore are frequently specified for this service. A special form of internal gear pump, the Gerotone has an inner toothed element and meshing outer toothed element. The inner Gerotone has one less tooth than the outer and the meshing tooth space forms a chamber for entraining the fluid from the inlet to the outlet port. (See Figure 1).

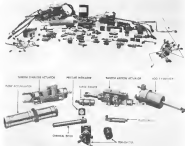
The relative motion between the inner and outer element teeth causes the oil chamber to be unstable - always changing in size - so that it always contains a minimum as it passes the inlet port - Fig. 1 - and always closing off the outlet (See Figure 2). This makes for a steady delivery independent of variations of inlet pressure elements. Thus, turbulence is not present and foaming is avoided, after each pumping being maintained at all altitudes.

Gerotone pumps are simple and compact in design, reliable and have high volumetric efficiency due to the fluid-tight engagement of the Gerotone which maintains high pressure at high pressure. In other words, this volumetric output pressure is maintained for its life because of the bearing tooth principle.

For engine lubrication and solvent service are common Gerotone pump applications. In addition they are frequently specified for helicopter transmission and pumping of oxidants for rocket engine equipment in aircraft and ground vehicles.

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GAIN IN SIMPLICITY is shown by comparing old design and new system components.

ally during landing when the radio is switched on.

The stabilizer actuator is so designed that each half of the tandem cylinder has 90% of the capacity of the main pilot actuator. Except as the main system moves, either of one system will have no noticeable effect on the longitudinal control of the airplane. Furthermore, the limitation will only affect the amount of control deflection, as governed by the hinge moment, and will not affect the rate of control as low movement in normal maneuvers involving moderate hinge moments.

In the alternate actuator, each half of the cylinder has only 50% of the load output of the old system so a reduction in ultimate control power will be experienced if one system fails. However, the loss of control capacity will much limit the performance of maneuvers requiring maximum alternate large maneuvers. There will be no change in control limits as to the rate of deflection at low hinge moments.

Lost Stick

Because of the complete independence of the two systems, no single hydraulic failure can result in the loss of both systems.

The safe single occurrence which can have this result is engine seizure for a much less drastic result, on one flame out. For a less likely one these is an emergency hydraulic pump powered by an electric motor and fed into the boost system. In the event of simplicity and to eliminate the need

for pressure switches, transfer valves, etc. there is no alternate take-over.

The emergency system must be turned on by means of a switch on the pilot's left console.

Because the control valves block the fluid in both sides of the actuator cylinder, a loss of hydraulic pressure resulting from engine seizure will not permit the tendons to move as long as the control stick is not moved. Therefore the emergency pump must be turned on following engine seizure before any control manipulation is attempted.

If the control stick were moved too much before the pump was turned on, the oil pressure trapped in the oil-charged accumulator would be lost and

Pilot's Comments

Lo Hsieh-chia, Republic test pilot, who first flew the tandem system on 20, 1955, said the pilot's control order to fly. Although the critical dual was expected to be the same focus in the previous system, the flying became more light.

Jack Bate, Republic's assistant director of flight operations, later tested the F-84F on each of the three test hours and could find no difference. Republic was that for F-84F pilots who have flown the F-84F with the tandem system after that in difference in light control system can be noticed regardless of which hydraulic system is operating.

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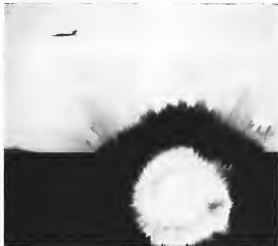
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the previously irreversible control surfaces would be "free." The pilot might find himself in an uncontrolled situation without engine thrust before he had a chance to turn on the emergency pump. However, a flight check of that possibility indicated that there was enough time either to turn on the emergency electric pump or to eject.

The electrically driven emergency pump has the same capacity as that in the original installation so there will be the same degree of control. It is actually possible to fly combat on the emergency pump. Replicable experience.

The T-385 goes one step further as emergency system simplicity and has the pilot with a lever to push a master battery cut as the batteries from the side of the plane to drive the main

power pump. Instead of half of the engine system being into the ability circuit, the P-105 has two independent power circuits.

Tandem Drawbacks

A price must be paid for this simplicity. One part of the price is that once the emergency system is tied into the main power system through a check valve, a low failure in the power half of the main tandem system will result in loss of the emergency system as well.

Another part of the price to be paid is the higher machining tolerances that must be held. Some good valves have always required a very high grade of machining. Keeping the discussion of a long dual valve valve in that both systems will really work together presents an even greater problem,



Sea Venom Pull-Up

Aerialists team of Royal Navy Fleet Air Arm Supermarine Sea Venom straight up in March 21 Sea Venom fighters, Lt. Col. P. G. Young, squadron commander at base leader. Sea Venom checkered lap tops, planes are marked with white on flying boom insignia.



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*APS—Advance Planning Service



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Honeycomb

Corvus at Port Wier, Tex., is making steady step honeycombs on its own machine (left) for cases of sandwich panels in 3 1/2 primary structures. Boeing Airplane Co., workers at Seattle (right) are about to add a contour on a honeycomb that has been formed by being frozen in water. Long approved as an ideal way to brace sandwich skins while without weighing them into monocoque structures, honeycomb has not had wider use because of the difficulties of fabricating, handling and forming in volume production. Such advance handling (Corvus uses it but had success with sheet 621) opens plastic offered and metal honeycombs are used to join the honeycombs to the skin. Growing importance of honeycomb can be judged from increasing number of aircraft manufacturers who are incorporating it into production lines. For example, Avco Manufacturing Corp., Middletown, Ohio, has recently installed both metal honeycomb press and adhesive bonding plants.

Corvus Metals, the Long Island firm that has produced much of the development industry, has found

After building 175 F-84's, Republic decided that the Thunderbolt needed all-new rig. Subsequent substituted for that original integral structure for adequate high-torque output necessary.

The change in structure meant that the 1 1/4 in. was made, added with a 100% hydrostatic test between the pilot and the control surface. (Obviously it was not out of the question to ask a pilot to maneuver the pitch control.) Consequently Republic found itself asking which control to select device to avoid making the pilot dependent on an one mechanical unit without alternatives in case of failure.

Two years ago it reached the point where there were three pitch buttons for the pilot to choose in case of control system failure.

"Small wonder," Lockheed Engineer Herb Quinlan said, "that with the glare acting and sounding timer and a couple of the warning lights on the panel would dim, until the service manual and push out a few quick buttons as we flew between. Then after thought, having himself up, he would be the 'good' button."

The general wall, as the tandem action came from the hydrostatic test enough going. In effect, the group decided to obtain more positive results in having two completely inde-

pendent systems continuously operating to parallel rather than stand by, then alternates with complicated electronic channel interlocks between a state of dependent system.

Rebuilding the 150 F-84's in order was at Middle and Ogden Air Force Depots. It is estimated that it will take 1,000 man-hours per aircraft wing of least 5 was cost to carry out the rebuilding job. Under T.O. 15-1 (4-571) with an 40 pages of parts lists. This work includes removing all hydraulic components and tubing of the previous design in the aft fuselage, approximately 75% of all the hydraulic components and tubing to the engine compartment, approximately 75% in the forward fuselage, and the installation of all new components, fittings and tubing in these sections of the aircraft.

Australians Still Want to Build Lockheed F-104

Reports in British and Australian press that Australian government and RAAF are coming toward plans to produce the Lockheed F-104A in Australia under license were denied in Australia. While, Reports that British government bought on Australia to supply two British fighters, possibly the P-1 of English Electric Australia, however, air warfare requirements to manufacture the F-104A.

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Four Cincinnati Mills working on California steel. The one in the left is pouring cold metal into.

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The one left of center is pouring a wide slab of 1410 Aluminum. One in center is pouring in the control on cold-chamber steel. One in right is pouring right in chamber in cold-chamber.



When it is done, pour it into a Cincinnati Mills' ladle and it will be ready to use.

•CECOSTAMP•

The casting is done in the pouring ladle in the chamber left.



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Write 340 for latest CECOSTAMP Bulletin! Write CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa.



Test Firing

Fig. at Holloman Air Development Center for testing Cessna F-302 inside long, narrow tube photo of both of F-302 has been released in near mode has shown. These cases as Higher F-302 in test results. Test firing also is done as in at right done over 120 mi. Holloman range.



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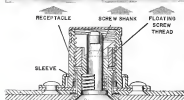
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THREE main subassemblies of new high-strength fastener: receptacle screw shank, and floating thread element. Top photo shows the separate subassemblies and bottom drawing shows a section cut through the complete fastener. Noticeable feature of the assembly, excepting an attaching ring, is the heavy quality of the parts.

High-Strength Fastener Developed For High-Performance Aircraft

A new high-strength quad-operating fastener has been designed by Victor F. Zabolodskii, Somerville, N. J. The manufacturer claims that his fastener combines the strength and clamping action of an anchor bolt with the quick action of a quarter turn, pinch fastener.

The inventor said the development of the fastener had been prompted by the growing need for a superior strength joining device to secure access panels that usually were the stressed skin of high performance aircraft.

Clamping Action

The need for a fastener which possesses the clamping action and self-locking ability of a permanent fastener. But it also must be capable of being expeditiously removed and replaced many times without losing these qualities. Added obstacle to a successful design is the likelihood that the fastener will be subjected to 500,000 P-SMP (pounds per square inch) compressions during high-Mach number ascent.

Zabolodskii has achieved these requirements by using a two-part screw

Upper element the head and shank come out of the receptacle but the screw thread remains behind.

The two parts are joined together so much the screw shank to screw after quarter-turn coil and pinch fastener.

When assembled the shank half of the screw is bayoneted down through the floating thread element and is given a quarter turn so that the screw comes out at the end of the shank sticks up on two ledges against pressure on the thread element end. Now the two parts of the screw act as one, engaging up the shank screws so the thread can assembly can proceed as if the fastener were a conventional screw.

Welding Action

For self-locking locking action the thread element is slit so that it is free to pivot.

As the element's threads bear up against the heavily threads inside the receptacle they ride up causing a wedging action which secures the



The Book You'll Want For Ready Reference!



Check these features

SLURRY TREADS . . . a wide choice of tread patterns to all types of floors, including concrete, tile, wood and aluminum. Treaders, made Darnell Cams and Wheels highly adapted to rough usage.

SELF-PROTECTED . . . by self-piercing. Darnell Cams give longer, care-free life wherever water, steam and corrosive chemicals are freely used.

LUBRICATION . . . all valves and wheel bearings are factory packed with a high quality grease that "breaks up" under attack by heat and water. Such fittings are provided for quick greaseable lubrication.

STRONG GUARDS . . . Even though inlet and outlet pipes may wind around the hub, these strong guards leave easy rolling of all sizes.

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**TEMPERATURE, CORROSION
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Titanium Titeflex Metal Hose made from brass, monel, incoel, bronze, and stainless steel, covers all types of engine and vehicle liquids within an extreme temperature and pressure range for every type of aviation engine—including the most advanced jet and engine still in the drawing board.

Some of its applications in a metal hose or component part for both jet and reciprocating engines:

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- Fuel lines
- Ignition harness
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Direct element freely against the screw thread.

As a secondary safety locking, when a wing-loaded element on the screw thread holds the screw in its security in the notch on the thread element holds until the element has been unscrewed up into tension.

To increase the element's ability to take high driving torque Zohndolich has incorporated the American Screw Co.'s recently patented Torq Set as an option on their Phillips-head screws. The design shows that (AWI July 9, p. 62). Thus the final tightening should be even greater than a comparable steel conventional permanent fastener.

As a comparison product for the high strength element Zohndolich has brought out what he feels is an improvement upon his quarter-inch "Protec" fastener currently being manufactured under license from the Seville Manufacturing Co., (Watkins, Conn.) It is with the improvement "Sonic". Both new fasteners will be manufactured by Zohndolich's firm, V. Zohndolich Aircraft, Ltd., in Seemst, N.J.

**Air Industry Growth
Shown By Census**

United States aircraft industry production in 1958 was valued at \$1,449 million, an increase of 49% over 1957, preliminary data based on a detailed industrial census by the U. S. Department of Commerce reveals. Actual statistics were released only in rough and complete information is expected to be available soon from the Bureau of Census.

The Census gives the increase in terms of value added, which is the value of work done in the industry less cost of materials, supplies, fuel, electric energy and contract work. The report covers all lines manufacturing or assembling complete aircraft, helicopters, gliders and lighter-than-air vehicles and companies doing modification, conversion and overhaul. Other segments of the industry, such as engine, propeller and equipment builders are not included in the report.

Census data on value of work done also includes that of secondary products, contracts and repair work and scrap sales, the total \$52 million. The \$1,315 million product value covered \$1,445 million of complete aircraft, modifications and conversions and other services primarily to airlines and 553 million in aircraft parts, engine parts, instruments and accessories. Figures were collected by the Bureau under legislation providing for a new set of manufacturing census five years, with the next one due in 1963.

**Supercharger Raises
Helicopter Altitude**

Los Angeles—Problems of altitude and altitude that have limited helicopter operations are being overcome with a supercharger manufactured by McCulloch Motors Corp., and adapted to the Heli 12-B and 17-C helicopters.

Applied to the 12-C using a conventional main engine model CV-4-320-C37, it provides increases in altitude performance by maintaining rated sea level horsepower (100) up to 7,800 ft. CAA tests proved heavy loading performance increased 4,500 ft. to 8,600 ft. at maximum gross weight.

Service testing of the craft has been increased through supercharging to 15,000 ft. Altitudes of more than 16,000 ft. have been attained.

Rate of climb capabilities of the aircraft improved, with approximately 400 ft. per min. reported possible at 16,000 ft.

But neither helicopter operation improved, nor only with but weather conditions light deterioration, but over supercharging performance at standard temperature.

Supercharger is believed to be a pilot-mounted on the tail rotor drive, with a two-position pilot-operated clutch.

Total of 75 lb. of flight testing by the supercharged helicopter resulted in an important service difficulties.

**Germans Order Home
Built Military Planes**

Bonn, Germany—West German Defense Ministry ordered 671 military airplanes from German firms. The first batch, totaling 58.3 million, are usually for aircrafts, the capacity to be bought abroad. The mission will be the Lockheed C-45 in the built by Messerschmitt-Mercedes in Munich within 1958.

Fokker-Wulf AG, Bremen, working with Focke-Blum at Dosseldorf, will build 194 Fokker F-44 trainers, Flugzeugwerke Nord GmbH, consisting of Messerschmitt AG, and Heinkel AG, will build 160 Focke-Flugzeugwerke GM 170R Magister French jet trainers, and Flugzeugwerke Nord GmbH, consisting of Wessling AG, Humberg Flugzeugwerke GmbH and Heinkel AG, will build 117 Focke-Flugzeugwerke 2501 Noratlas transports. All will be built under license from.

An order for 459 German Do 27 reconnaissance planes was placed some months ago with Dornier. The first planes from this order will be delivered early in October.

**New... Titeflex
high-temperature
HOSE CLAMP**

**Withstands all Stresses
Common to high-temp
Clamp Applications**



This new cushioned Titeflex Hose Clamp is made from tempered stainless steel. It is lined with shock-resistant metal mesh that strains at shape, cushioning quality and grip despite excessive heat, pressure, and the strains of such vibrations and engine heat.

Also, at long last, is a properly designed clamp with vibration resistance and positive clamping qualities. It is the all-purpose clamp for all hose and tubing connections in jet engines and other high-temperature applications.

Here's the one clamp that can nearly any application on a jet engine for ease of installation plus unlimited shelf life and additional operating advantages. This will permit you to maintain an one change—the Titeflex high-temperature clamp.

Titeflex

HIGH-TEMP CLAMPS

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The most significant reason why the Scintilla Division of Bendix has long been recognized as the leader in aviation ignition is that Bendix-Scintilla designs, engineers and manufactures every component of the ignition system.

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to work together give more efficient performance and require less attention in original installation or later service.

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plug leads, ignition plugs and control harness as well.

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Rocket Test Vehicle

Behind Alouett III, under test vehicle, one of several test requirements for rocket engine tests performed by Bendix, is bracketed from ground support. Bendix rocket motor test cell encloses the vehicle in suspension speed which tests customer under test area. Bendix is making motor test for solid propellant boosters. 120 in. altitude range search vehicle; long high altitude short, and tested by Argus Air process. Bendix is investigating other materials for cases, using them semi-empirical glass fiber. Plastic materials are incorporated in design of some engine test type, and Duratone (phenolic resin impregnated asbestos) is commonly used in tailpipes.



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VISION

Working closely with the Army, Navy, and Air Force on many diversified projects, Bendix is pioneering future flight research including the design of high-speed airway search, advanced engine development... and advanced VTOL, STOL, design.

DEVELOPMENT

High-Mach research including design for supersonic.

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The Army's W-54C utility helicopter.



ENGINEERING: One of the preeminent with an industry leader in an ideal California locale.

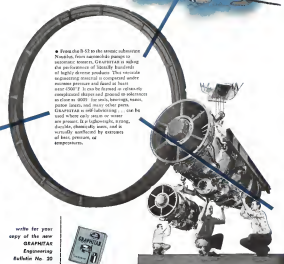


GRAPHITAR® is the main shaft seal PRATT & WHITNEY J57 turbojet

• Boeing's B-52 Intercontinental Bomber, the striking arm of our Strategic Air Command, is powered by eight twin-spool axial flow turbine engines manufactured by the Pratt & Whitney Aircraft Division of United Aircraft Corporation, East Hartford, Connecticut. These turbojets are in the 10,000 pound thrust class and in engines of this order, complete dependability is vital. One of the components of the J57 is a GRAPHITAR seal used on the turbine main shaft which, naturally, is turning at high speeds. The GRAPHITAR seal also easily withstands the maximum operating pressure developed in the engine. The data in the face of the seal shown on the opposite page (approximately 15,000 psi) are for pressure balance and sealing. This Main Shaft Seal is just one of several GRAPHITAR seals used in the J57 engine. GRAPHITAR parts can survive such taxing physical conditions because they are strong, self-lubricating, and practically inert. GRAPHITAR has excellent wearing properties and cannot be corroded by most chemicals. Where the application is tough, and complete dependability is most essential, GRAPHITAR is the engineering material to specify.



in the
engine



• From the B-52 to the atomic submarine Nautilus, from automobile pumps to electronic timers, GRAPHITAR is adding the performance of literally hundreds of highly diverse products. This versatile engineering material is compressed under immense pressure and fused at least over 1500°F. It can be formed in virtually complicated shapes and ground to tolerances as close as .0001" for seals, bearings, valves, pump liners, and many other parts. GRAPHITAR is self-lubricating... can be used where other seals or no seals are present. It is lightweight, strong, durable, chemically inert, and is virtually unaffected by extremes of heat, pressure, or temperature.

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Bulletin No. 30



THE UNITED STATES

GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN



happy birthday,

"TRUCULENT TURTLE"

In September, 1971, the U. S. Navy, services set to lead new joint leaders, and the 1st FVF of the Lockheed production line, dubbed it "The Turtle," and leaded for the Lead Drive Under...

...Shooting light from Perth, Australia, with JAPD (and light) of the 1st FVF of the Lockheed production line, dubbed it "The Turtle," and leaded for the Lead Drive Under...

LOCKHEED

AERONAUTIC CORPORATION
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Look to Lockheed for Leadership

This historic Australian-Glen light is still the world's most-famous aircraft. On this, the 20th Anniversary of the successful flight of "The Truculent Turtle," Lockheed shares the gallant Navy pilot and crew members who wrote this brilliant and enduring page in aviation history. Like all airplanes designed and built by Lockheed, the original

Navy was tailored with advanced design characteristics... but permitting evolutionary improvements in subsequent FVF versions, as lower cost to the U.S. Navy. A total of 44 Navy versions for Navy as a tribute to their dependability, versatility and all-weather ruggedness—and to Lockheed's leadership in the design and production of long-range patrol aircraft.

Rocket Manufacturer To Expand Facilities

Boeing-Corpus, Inc. of Houston, Calif., subcontractor to Grand Central Rocket Co. for the third stage solid rocket assembly of Martin's Vanguard satellite project, has changed its name to Cooper Development Corp.

NASA through cooperation the company's concentration in the field of rocket and missile systems and electronic instrumentation development.

Cooper plans to build a division of the building and additional manufacturing facilities to house a large expansion. Operations and testing operations will be carried out in the space facility for production of the first ASB and WAST rocket systems. Cooper also designs and builds telecommunication systems, radar, radar systems, radar systems, components and control systems for the rocket systems.

Name change is effective Sept. 15 and does not indicate a change of management.

Aerogrip Corp. Acquires Lead Control Company

Aerogrip Corp., Jackson, Mich., has purchased Grand Central Rocket Corp., Pasadena, Calif., designer and manufacturer of aircraft lead control and fire control equipment. Sales of Grand Central Rocket, which has 50 employees, are expected to reach the \$1 million level within a year.

Five new products now being introduced are a special rope lock and a set of non-polluted welded, buckle for strap assemblies.

WHAT'S NEW

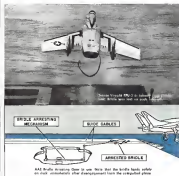
Publications Received

• On-Line Automatic Data Reduction, Technical, City, Houston, Texas, TX 11111—by C. E. Hill and R. E. Kistner, Arnold Engineering Center, U. S. Air Force—Available from OTR, U. S. Department of Commerce, Washington 25, D. C. 5-77 pp.

An automatic data reduction system capable of measuring, storing, computing and presenting results of a wind tunnel test in one continuous operation is described.

• The Enigma Spectrograph: Analysis of Titanium Metallurgy and Alloy, PH 121116—by E. M. Diefen and J. Yeh, Spectrochemical Laboratories, Inc., and J. L. Miller, Wright Air Development Center, U. S. Air Force—Available from OTR, U. S. Department of Commerce, Washington 25, D. C. 52-91, 100 pp.

NO MORE LOST BRIDLES...



THANKS TO ALL AMERICAN HIGH-CAPACITY BRIDLE ARRESTERS

In outgassing yet from the decks of aircraft carriers, each flight used to meet the loss over the side of the captured bridle.

The U. S. Navy has now installed All American's In-Capacity Bridle Arresting Gear on all aircraft carriers.

riders equipped with strong catapults. Briddles are now saved for reuse.

This is another engineering project that spotlighted All American's dynamic leadership in design, development and testing of new, vital equipment for the Armed Forces.

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OPTICS ?

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In the air, on land, or at sea, AO designed and manufactured optical systems are the eyes for almost endless variety of weapons.

In the role of prime contractor and subcontractor, America Optical is actively engaged in both the development and production of optical systems for air control, aerial reconnaissance, navigation and bombing systems, infrared search and guidance and radar and detection.

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Request Brochure S85
discussing America Optical
Company Defense Products
facilities and capabilities.

WHO'S WHERE

(Continued from page 23)

P. E. Huggs, design specialist, **Marvick Electronics Division**, National Aircraft Corp., Baltimore, Md.

James D. Euse, Jr., corporate management relations, **Boeing Aerospace Co.**, Seattle, Wash.

Willis J. O'Brien, public relations manager, **AC Spark Plug Division**, General Motors Corp., East Windsor, N.J.

Ellis F. Faria, district sales manager (Chicago, Ill.), **Continental Air Lines**

Harley B. Blochman, assistant to the president, **Consolidated Steel Industries Corp.**, Pasadena, Calif.

Rubert E. Mitchell, sales manager and **Lawrence Kasser**, chief engineer, **Deere & Co.**, Moline, Ill.

E. D. Eldridge, purchasing agent, and **Ira J. Beltrami**, personnel manager, **Teknograph Corp.**, Los Angeles, Calif.

Capt. Richard J. H. Cline (USN ret.), manager **Military Liaison Division**, Service Dept., **Flight Automated Division**, **Goodyear Aircraft Corp.**, Woodbridge, N.J.

Walter W. Spindel has received the staff of the Electrical Instruments Section of the National Bureau of Standards; he will be in charge of the Bureau's **Mobile Electrical National Laboratory**.

Joseph J. Polgar and **Walter J. Howell** are now on the professional staff of **Fluor Corp.**, Research Corp., Los Angeles, Calif.

Harold R. Jones, corporate engineer, **Engine-Power Division**, **Boeing Aircraft Corp.**, Tukwila, Wash.

Dr. Mark Gordon, former director of research, **Quincy Government Products Division**, **Arco Manufacturing Corp.**, Cincinnati, Ohio.

Frederick D. Stride, operations manager, **Boeing Corp.**, Wallingford, Conn.

Ernest E. Ghent has joined the staff (**Chemical Division**) of **Atlantic Research Corp.**, Alexandria, Va.

E. L. Smith, personnel director, **Vick Inc.**, Detroit, Mich.

Ed M. Goldkule, areas project engineer, **Advanced Electronic Products, Inc.**, Redwood City, Calif.

John A. Moring, assistant director, nuclear planning, **Island & Wilson Architects**.

Matthew H. Fure (Genl., retired) has joined **NASA Langley Flight Research Lab**, Hampton, Virginia; **Genl. Olin A. Anderson** is former director.

Donald G. McKee, central district sales manager (**Defense Division**), **Wildcat Fuel** Corp., assistant district manager, **Arco Fuel Products Division**, Forest, Ill., Ashland, Mass.

Robert W. Holmes, district sales representative (**San Francisco Office**), **Boeing-Power Division**, **Boeing Aircraft Corp.**, Seattle, Wash.

Raymond E. Phillips, plant supervisor, **Los Angeles Aircraft Corp.**

Robert P. Polak, Jr., general sales manager, **A. G. Kelly**, department head, product division, and **Robert D. Melton**, personnel and industrial relations manager, **Cul-Tann Corp.**, Los Angeles, Calif.



Actual test firing of a modern Rocketdyne rocket engine at the Field Test Laboratory on the Santa Susana Mountains.

The mightiest engines ever built will drive America's long-range missiles

Today's rocket engines are the most powerful in the world... and the power they develop is helping to make our nation's long-range guided missile program an operational reality.

Already **ROCKETDYNE** engines are being supplied for the U. S. Air Force SM-64 NAVARHO long-range, surface-to-surface guided missile

...the **Reconnaissance** surface-to-surface ballistic missile of the Army **Dennison Corp.**... and for many other large guided missile projects.

For the past 10 years **ROCKETDYNE** has been working closely with the Department of Defense, producing its rocket engines as required, and delivering them on time. Now and more powerful

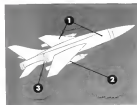
rocket engine designs for tomorrow's more effective missiles are in constant development.

ROCKETDYNE—lowering the cost that awakes you in rocketry. Please write: **ROCKETDYNE**, Personnel Manager, Dept. W-39, 6638 Canoga Ave., Canoga Park, Calif. ...20 minutes from Los Angeles in suburban San Fernando Valley.

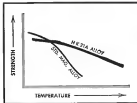
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BUILDERS OF POWER FOR OUTER SPACE

A Division of
North American Aviation, Inc.

NEW DOW MAGNESIUM ALLOYS CRACK HEAT BARRIER!



Now suggested for a broad range of uses in structure and aircraft, the new Dow magnesium alloys are available in the form of (1) sheet or plate, (2) extrusions, (3) forgings.



Maintenance of strength at high temperatures is illustrated by this chart. Performance data on the new alloys at elevated temperatures can be obtained by request.

High temperature magnesium alloys are available to lighten aircraft and missile structures

Once again the barriers for aircraft structural design have been widened. Dow has developed a series of high temperature magnesium alloys which are already in preproduction use on aircraft, missile and engine structures. These alloys show advantages at temperatures up to 700° F. Limited test data on properties up to 1000° F. are available for some of these alloys.

The new alloys have precision powders because of their good combinations of modulus and properties, including creep strength, at temperature. Shop characteristics include good formability and weldability.

One of the available alloys is the magnesium-thorium composition, HK31A, which is manufactured in rolled and cast forms. Under development is a similar alloy for extruded shapes and forgings. HK31A sheet and plate are available from stock and from current mill delivery schedules in standard sizes from 0.002" to 2".

These new magnesium alloys by Dow should be considered for your high temperature requirements. Contact your nearest Dow sales office or write THE DOW CHEMICAL COMPANY, Magnesium Sales Dept., MA 3036-1, Midland, Michigan.

you can depend on DOW MAGNESIUM



the CANADAIR contribution

Canada has received world-wide credit for the part she has played in the development of a strong NATO. Aside from material contributions to other nations she has made an equally important contribution to world peace by being strong herself... by keeping abreast of civilian as well as military progress throughout the world. Canadair is proud to be a part of Canada's strength in three important fields.



CANADAIR and GUIDED MISSILES

Canadair has long had a prominent role in Canada's guided missile program. The company's experience in advanced aircraft systems engineering is applied to the design and development of these new weapons systems for the Canadian government.

CANADAIR and AIRCRAFT PRODUCTION

Five native jet fighters, Canadair produces the Sabre fighter for the RCAP and other NATO air forces. The new, light, highly efficient fighter aircraft in European multi-squadron service, the Sabre jet has proved its superiority in actual combat.

THE Silver Star Bomber: This Canadair-produced jet aircraft has become the standard trainer for RCAP and NATO fighter pilots. Canadair CL-28C. This is the largest aircraft ever to be built in Canada, and will be used for reconnaissance duties by the Maritime Air Command of the RCAP.

CANADAIR and NUCLEAR PRODUCTS

In the new field of activity, Canadair's facilities for design, engineering, development and research are devoted toward the production of test reactors for the government authorities, Atomic Energy of Canada Limited. Canadair contributes to Canada's development program for the development of non-military uses for nuclear products.



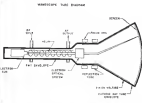
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AVIONICS



WANSCOPE, novel cathode ray tube which performs nearly all the functions of a complete radar receiver, has traveling wave tube amplifier built into its neck. Construction of new Syracuse tube as shown in schematic form in drawing (right).

Radar Receiver Built Into New CRT Tube

By Philip J. Klass

New York—Coffee my tube which, by itself, performs nearly all the functions of a complete radar receiver has been revealed by Syracuse and the Office of Naval Research, which sponsored its development.

By eliminating the normal tube local oscillator, mixer, intermediate frequency amplifier, detector and video amplifier, the new device is expected to slash radar receiver size, weight, cost, and complexity. Growth reduced complexity, Syracuse believes, should result in greatly improved radar reliability.

The device is called Wanscope, short for Wave Modulated Scope. It consists of a traveling-wave tube amplifier built into the elongated neck of a cathode ray tube, with a special electron optical system interposed between the neck and tube face.

Wanscope's cathode (350 me) emits electrons, which it admits into a tube with high-modulation index, which amplifies extremely short pulse lengths. The input surface detector ("hot") radar developed by Airborne Instruments Laboratory is a good example, a Syracuse spokesman says.

Now Available

Type 6767 Wanscopes, for operation over the 3-band frequency range of 2 to 4 kHz, are now in pilot production at Syracuse and available for immediate delivery to users from working on military contracts.

The tube has a 6-inch screen and uses P-7 phosphor. However, the company emphasizes that there is no pre-

tuned last on tube face diameter as the type phosphor used. Syracuse has built a Wanscope with a 13-inch face.

Available tubes have a maximum gain of 15 db and a sensitivity of -46 dbm. A spokesman says that the company is now in test process, sensitivity to at least -55 dbm, possibly higher. Because a typical radar requires a sensitivity of about -50 dbm, it is necessary to use external searching wave tube ahead of the Wanscope as an RF amplifier, Syracuse points out.

Using one of the new low noise 5-band traveling wave tubes now on the market in combination with a Wans-

scope should produce a radar receiver with a 6 db noise figure—comparable or better than most present conventional radar receivers, Syracuse says.

Velocity Sorting

Operation of the Wanscope is based upon velocity sorting of electrons which escape from the end of a helix of a traveling wave tube section. (See sketch, above.) An electron gun generates a dc beam which passes down the center of the helix where the RF input is applied.

Injection of the RF field in the helix with the beam causes both velocity



NEW WANSCOPEs can be built with one size screen, Syracuse says. Five-inch tube (top) is now in pilot production, 13-inch tube (bottom) is experimental model.



CANADAIR HAS PRODUCED
MORE SET AIRCRAFT THAN
ANY OTHER CANADIAN
MANUFACTURER

**The right people
with the right facilities
produce the
right solutions**



Observing performance of electronic equipment in the Electronic Systems Division's Radio Engineering Laboratory. From left: J. C. Tull, Manager—Radio Division, M. C. Long, Manager—Radio Engineering Laboratory, R. W. Perry, Assistant Project Engineering Manager and J. P. Parnell, Project Engineering Manager.

Component of Sylvania Communications Systems

"Packaged"

**to deliver top performance—
anywhere**

THE "PACKAGE" CAN GO anywhere, any time, in modern, high-performance aircraft, and deliver effectively in America's defense. It is an electronic communications system. Designed, engineered, and "packaged" for maximum weight, the equipment provides maximum reliability and top performance under extreme conditions of humidity, altitude, shock, vibration, and temperature differentials.

Engineered in the Radio Engineering Laboratory of Sylvania's Electronic Systems Division, this highly advanced elec-

tronic system employs subminiature tubes, transistors, and printed circuits in a package which is itself a subminiature. Despite its complexity of design and purpose it is engineered for quantity production in the Division's Buffalo plant.

In all of Sylvania's Electronic Systems Division installations, the right people work with the right facilities, with a sound managerial environment. That is why they have produced the right solutions to a variety of problems, and have made such important contributions to the fields of sensitive electronics, guided

missiles, communications, communications, radar, computers and control systems. Whether the problem is military or industrial, Sylvania's business is to come up with electronic solutions that are profitable.

In addition to its Buffalo Engineering Laboratory and manufacturing facilities, the Electronic Systems Division has installations at Mahwah, Mass., and Mountain View, Calif., staffed with top-ranking scientists and engineers, and backed by Sylvania's extensive resources in the electronics field.

SYLVANIA IS LOOKING FOR ENTERPRISING ENGINEERS

Sylvania has many opportunities in a wide range of defense projects. If you are now engaged in defense work, you are invited to consider

Edward W. Debe, Manager of Personnel, Electronic Systems Division, Sylvania Electric Products Inc., 190 First Avenue, Mahwah, N.J., Mass.



SYLVANIA

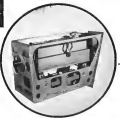
SYLVANIA ELECTRIC PRODUCTS INC.



LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY



Buffalo Engineering Laboratory's large and modern testing facilities occupy 150,000 square feet of floor space in Buffalo's new center at 175 Central Avenue, Buffalo 3, New York.



is under development by the company. The Waspac was developed by Sylvania's Research Center, located in N. Y. The name was suggested by three Naval Research Laboratory scientists, Neil E. Davis, Basil W. Fisher, Jr., and Roger E. White, who were associated with the project.

5555 FILTER CENTER 3333

► **Size Of The Team—Douglas DC-8 jetliner will carry 1,200 lbs. of avionic equipment, costing \$149,800—more than the entire cost of a prewar DC-3.** Douglas Engineer R. H. Jensen reported during the recent Western Electronic Convention (Waselec), 60-day exhibiting figures on DC-8 systems installed.

- **1,200 lb. of war and installation for Waselec.**
- **4 to 7 ms. of time.**
- **25 radio systems and 30 antennas.** Three of the antennas are external types and two are airfields. DC-8 will use an external VHF communications antenna whose aerial drag, plus weight, is only 14 lb., compared to 40 lb. required for a bulk antenna, presently reported. (On DC-8, one sq. ft. of parabolic drag area is equivalent to 1,700 lb. of actual weight.)

► **Collins ATC Transponder—Collins Radio is building approximately 50 air traffic control transponders because the service has been selected widely. Unit weighs about 35 lb.**

► **New Mind, Tulsa—Sylvania has announced a new line of seven subminiature tubes, designed under military contract, for guided missile applications. The new tubes, which are available for evaluation by companies engaged in missile work, include:**

- **8N-1774A: RF sharp cutoff pentode**
- **8N-1777A: Semi-variable RF pentode**
- **8N-1775A: Audio amplifier.** (The tube recently has been released to military types in Type 6780.)
- **8N-1777A: Audio beam power pentode**
- **8N-1776A: Medium-Mu single triode with relatively high μ , for general purpose use up to 350 mc.**
- **8N-1802A: Medium-Mu double triode**
- **8N-1803A: High-Mu double triode**

► **Sperry Rand IBM Agreement—Sperry Rand Corp. and International Business Machines Corp. have entered into non-exclusive licensing agreement to exchange rights to manufacture patented and unpatented machines and also transfer data processing machines under patents and patent applications in ex-**



**with TI transistorized
intercom**



TI transistorized intercoms helped Lockheed trim 55 lb. of dead load from the P-7V sub-hunting Neptune... by transistorizing past one system—the 14-station intercom. In addition to saving weight, safety and reliability were increased while maintenance and power drain were reduced.

Well values MIL-T-5400 for general performance, MIL-T-5423C for environment, and MIL-T-611B for maintenance, the TI-built system has a 3000-hr minimum cycle and an exceptionally long service life. Signal response is instantaneous without need for warm-up. There is negligible power drain on standby and negligible heat dissipation while in use. The system takes power directly from a 28 Vdc line and uses less than 6 watts per station.

This is one example of Texas Instruments system engineering now being applied to audio, radio, radar, sensor, infrared, and other systems for communications, navigation, search, fire control, and missile control. Continuing progress over a quarter century has resulted in over a third of a million sq. ft. of engineering and manufacturing facilities—soon to be doubled—located in an excellent disposal area.

For fundamental design and development... for manufacture of reliable systems that save weight, space, and power... for scheduled commitments delivered on schedule... call on TI application engineers. Write to Application Division...



TEXAS INSTRUMENTS

INCORPORATED

3000 LEMMON AVENUE DALLAS 5, TEXAS



ZERO mission 6 hour A G-5 test vehicle, still shrouded in the early morning darkness before launching, represents more than a decade of research and development.

At General Electric, George F. Metcalf reports:

New Department to Help Solve Complex Defense System Problems



GEORGE F. METCALF, is General Manager of General Electric's new Special Defense Projects Department, located in Philadelphia, Pa. Mr. Metcalf has had extensive management experience in the military electronics field, both in General Service and in the General Electric Company's Electronic Division.

Realizing the increased complexity of some of the nation's current defense system problems, General Electric has formed the Special Defense Projects Department. The new department will act as a Company focal point for large, highly complex missile projects. Headquarters for the new department will be located near Philadelphia, Pa. This new department has responsibility for large defense systems that require the combined research, development, and manufacturing resources of many of General Electric's operating departments and laboratories.

Manned by a highly skilled engineering and development staff, the Special Defense Projects Department relies upon

General Electric operating departments and laboratories for many specialized phases of its defense projects.

The Special Defense Projects Department is making significant contributions to America's defense program by focusing the wide range of specialized talents of General Electric on highly complex defense system problems. Section 224 A, General Electric Co., Schenectady 5, N. Y.

MEMBERS: G E's Special Defense Projects Department is currently expanding its staff of highly skilled engineers and scientists. If you have a background of successful, creative engineering, send your qualifications to: Mr. George Metcalf, 2185 Chestnut St., Special Defense Projects Department, General Electric Company, Philadelphia, Pa.

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THESE G-E CAPABILITIES ARE AVAILABLE TO

NEW SPECIAL DEFENSE PROJECTS DEPARTMENT



BASIC RESEARCH



COMMUNICATIONS



HYPERSONICS



METALLURGY



MATHEMATICS



THERMODYNAMICS

and then we built



This 7 pitch, 28.1264" pitch diameter internal gear for the Sikorsky S-55 Main Transmission

This HARD (Rockwell "59C") gear is cut after best trending to master gear standards

.0002" per inch maximum lead error
+.0000 - .0003 arcuate error
.0002" tooth spacing tolerance
60 RMS finish

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INDIANA GEAR WORKS, INC. • INDIANAPOLIS, INDIANA

NEW AVIONIC PRODUCTS

Components & Devices

• Subminiature ceramic capacitors, Series 2500C, maintain 50% of rated capacitance over temperature range of -50C to 125C. Capacitor is rated 200



voltage ratio 4:1. Available in five sizes ranging from 0.0033 to 0.01 mfd. Veho Engineering Sales Co., 2538 So. Highland Ave., Los Angeles 10, Calif.

• Miniature clutch/brake, model 10, dry powdered steel. Model No. 10 clutch provides proportional control, is rated 50 in./oz. at 1,000 rpm and has output inertia of 1.83 gm cm². Speed of re-



sponse is 2 milliseconds. Free ends line and electronics slip rings and internal bearings. Model 10 built for smaller torque using Electronic Vicks units, Inc., Greenwich, Conn.

• X-band rotary joint, Model R2750/1, S&I, ball-bearing non-contact coupler can handle 100 kw. peak power for short periods, 150 kw. for extended periods. Unit uses preloaded ball bearings to prevent change of characteristics during rotation. VSWR is less than 1.10 over frequency band of 8.4 to 9.6 kmc. Lefter Industries, Components Div.,

PROVED... protection under high-g SUSTAINED ACCELERATION of the new F-10 CLASSIFIED*



"Only All-Angl Barry Mounts gave effective isolation..."

* One of the newest and hottest fighter aircraft now flying gives its electronic equipment such a violent diet, when maneuvers are turned on or off, that sustained accelerations bottom out MIL-spec mounts — making vibration protection fail.

But in the same aircraft, All-Angl Barry Mounts protect the power uses of Liquidometer's low back-gaging system, maintaining vibration isolation under sustained accelerations up to 6g vertical and 3g horizontal.

The pilot's life — and the success of his mission — literally depend on the tenacity of his fuel-pipe readings! And these readings depend on the precision reliability of the vacuum tubes and circuitry in the power units.

- In any mounting position
- Through every attitude of aircraft or missile
- Under sustained high-g acceleration . . .

... All-Angl Barry Mounts give sustained protection of reliability. Write for Data Sheet 256-01 giving details. For specific recommendations, call your Barry Sales Representative.

Barry's new Western Division, in Redwood, California, offers fast, on-the-spot design and prototype — research and production of special systems.

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SALES REPRESENTATIVES
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I call
Packard Electric!"

Huge production gives important advantages to bulk cable customers of Packard Electric

You don't have to sacrifice a thing or compromise rigid aviation safety standards to get cable at a price that's right.

From pre-World War II times, through the tremendously accelerated defense production schedules to the present, Packard Electric has always made uniform high-quality aviation cable available to airlines and engine manufacturers. Many times our engineers have worked closely with leading aviation firms to develop new cable to meet the emerging standards of the industry.

The resultant know-how has given us the ability to assure uniform high-quality cable production of relatively low cost. Our huge production capacity tops 7,000,000 feet of cable a day and is the largest in the aircraft cable manufacturing industry. This volume makes possible additional advantages in bulkable customers without a reduction in quality standards.

Yes, the right price has to include uniform high quality, advanced cable engineering and dependable delivery

... all available when you take advantage of Packard's years of experience in aviation cable manufacture backed by the industry's most extensive and modern production facilities.


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ELECTRIC

General Electric Division
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Office in Detroit, Chicago, and Galesburg, California • Aviation, Automotive and Appliances Wing

the increasingly difficult overhead production schedules in its parent, Packard Electric has always made uniform high-quality aircraft cable available to airlines and engine manufacturers. Many times our engineers have worked closely with leading aviation firms to develop new cable to meet the emerging standards of the industry, the biggest in the aircraft cable manufacturing industry. This volume makes possible additional advantages in built-to-order customers without a reduction in quality standards.

Yes, the right price has to include uniform high quality, advanced cable engineering and dependable delivery.

 **Packard**
ELECTRIC CO.

General Electric Division
Grand Rapids, Warren, Ohio

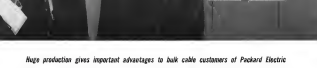
For more information, contact:

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"When I want cable
that's priced right,

I call



You don't have to sacrifice quality or compromise legal aviation safety standards to get cable at a price that's right.

From pre-Warfare World II times, through the tremendously accelerated defense production efforts of the


The resultant know-how has given us the ability to assure uniform, high-quality cable production at relatively low cost. Our huge production capacity tops 7,000,000 feet of cable a day and is the largest in the aircraft cable man-

... all available when you take advantage of Patdon's years of experience in aviation cable manufacture backed by the industry's most extensive and modern production facilities.

Packard Electric has always made value-based marketing decisions, and this new book is no exception. The volume makes possible additional advantages to bul-

able to withstand engine man-
ufacturers. Many times our engineers have
worked closely with leading aviation
firms to develop wire cable to meet the
cable customers without a reduction in
quality standards.

Yes, the right price has to include wire
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SPECIFICATIONS—R5100 Plus Switch is

Flow	1.5 GPM
Weight	0.70 lb
Operating Pressure	70 PSIG
Temperature Range	-65°F to 250°F

Know when a fuel line runs dry... this Reverse flow switch flashes a pilot light. Use a venturi to create differential head during fuel flow to fill float cavity; this causes float and magnet assembly to actuate hermetically sealed Glaswitch®. Air replacing fuel in line drains switch cavity reversing switch action. Small size... low pressure drop.

SPECIFICATIONS—T-2122 Flow Switch

Flow:	3000 FPM and
Weight:	1.2 lb.
Operating Pressure:	30 PSIG
Temperature Range:	-5°F to 150°F

GLASWITCH



T0042 and 1

Keeps when a fuel line runs dry	New	3000 RPM with
...this Revere flow switch	Weight	1.25 lb.
Flashes a pilot light. Uses a	Operating Pressure	25 PSIG
constant 40-psi pressure	Temperature Range	-45°F to 150°F



Ask for Engineering Bulletin 1088 and

2008 describing these Rivers Flow Inst.
 also. Other items available:

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NORTH AMERICAN HAS BUILT MORE AIRPLANES THAN ANY OTHER COMPANY IN THE WORLD



ABOVE THE OCEANS

The F-4—versatile, fast, maneuverable and longest ranged FIGHT of them all—has completed its carrier suitability and fleet indoctrination tests. The latest addition to the Navy's operational squadrons is a product of North American's Columbus Division. Here, faster, more effective manned aircraft are in continuous development—as they are in North American's Los Angeles plant, birthplace of the F-100 SUPER SABER and the F-26 SABRE JET. This ability to deliver tomorrow's aircraft—in quantity, on time, and at lowest possible cost—has made North American Aviation a major supplier of advanced aircraft for our country's defense.

ABOVE THE CONTINENTS

Even before the close of World War II, North American was at work in the most technological world of guided missiles. One of today's major results of this pioneering is the SM-64 NAVARHO INTERCONTINENTAL MISSILE. North American has developed guidance systems, automatic navigation and flight control systems... as well as engine and rocket power... for this important Air Force project. North American's work on the NAVARHO and other weapons systems is now creating long range missiles to fill a high priority need in our nation's defense.

North American Aviation, Inc., 120 Maple Street, Maple Park, Illinois 60151 • Columbus, G., Reader Service

NORTH AMERICAN AVIATION, INC.

Engineers work for details regarding challenging problems now open



A **Capital** IDEA:



JOY AXIVANE® FANS
AIR CONDITION
VISCOUNTS!

new airliner makes most of **THIS** space-saving design

CAPITAL AIRLINES is proud of its spanking new turbo-prop Viscounts. The finest aeronautical and electronic know-how has been employed in the development of this amazing new airplane.

This advanced thinking is apparent, too, in the Viscount's air conditioning system. For the heart of the system they selected a Joy AXIVANE Fan . . . and used to full advantage the inherent space-saving characteristics of this unique *in-line* fan design. Because Joy AXIVANE Fans can be installed in the door, they may be located in any part of a plane that

has ducting. Light-alloy magnesium and aluminum construction save weight but give the greatest vibration-resisting and shock-resisting strength.

FROM 10 CFM TO OVER 6000 CFM is the range of outputs of Joy AXIVANE Aircraft Fans . . . in weights from 10 ounces to 30 pounds. Joy Axivane Aircraft Fans are working, today, in Grumman, North American, Douglas, Martin, and Sikorsky Aircraft. You can put them to work in yours, too. For details write Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa. In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario.

JOY
WORLD'S LARGEST MANUFACTURER
OF VANE-AXIAL FANS

Write for FREE Bulletin 124-59

WE'VE GOT AIRCRAFT AIRCRAFT FAN REQUIREMENTS JUST TO COME. 10 AMP AND MANY EXCEEDING. WE'VE GOT 10 STANDARD VANE-AXIAL FANS IN A LARGE RANGE OF PERFORMANCE. DESIGN RESEARCH AVAILABLE ON REQUEST.

Consult a Joy Engineer

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output of 200 kw and is operationally similar to Type 4T50 fixed frequency tube.

• Tracking wave tube amplifier, Model 510A, has output of 10 aw over 2 to 4 kHz band and a VSWR less than 2:1. When amplifier modulated by grid, amplifier operates from 0 to 100 mc. has 5 milliwatt-average pulse rate and at maximum power output and a



pulse duty of approximately 15 pulse-per-second. When phase-modulated by helix, amplifier has bandwidth from 10 cps to 10 mc and requires 30 volts input for 100 dbm gain. (Bench model shown) is priced at \$1,335. Rack model costs \$1,395. Wave-Tube Corp., 550 Kaysville St., Redwood City, Calif.

Computers & Data Processing

• Converter for use with X-Y plotters, accepts input from punched paper tape obtained directly from output of a dig-



ital computer, extracts desired data for plotting. Converter accepts a 0.1% Librascope, Inc., Glendale 1, Calif.

• Channel processor, Model GPS-6 and GPS-11, operates at speeds 5,000 times faster than test time. Wide variety of basic and non-linear computing elements and special function processors are available. GPS Electronics Co., 811 Boston St., Boston, Mass.

• Divide function generator, Type DFG 405, five-channel, capable of generating two or more variables, for use with analog computer. Flexible switching arrangement allows the number of segments in each channel to be varied at coding to function being generated. Built-in calibration circuit permits quick

Better way to keep tab on thirsty engines



Advanced

Bendix FUEL FLOW TOTALIZING SYSTEM

TYPE 9130

makes news because it . . .

- is designed for commercial and military jet and piston aircraft—both multiple and single engine.
- Reports fuel consumption from 400 to 2,200 PPH* for individual engines (Type 34700 indicator) . . . and total consumption for all engines (Type 34722 or 34730 indicator).
- Provides system accuracy of 2% individual rate and 3% total rate.
 - Is pressure tested to 1000 psi.
 - Has low pressure drop—only 1.0 psi.
 - Is simple to install and service.

*Minimum engine altitude

Development of new, faster—and smarter—commercial and military aircraft makes it even essential that you have complete and accurate indication of fuel consumption. The new Bendix Fuel Flowmeter System features fuel flow computers and indicators specially developed for today's jet and turbo-prop—greater accuracy for fuel details check with POWER CENTRAL SYSTEM, BENDIX AVIATION CORPORATION, MINNEAPOLIS, MINN. P-C offers qualified engineers challenging, profitable careers.

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Famed for its combat superiority with the United Nations in the skies over Korea, the Sabre Jet is now being supplied to other NATO countries.

Twin Coach Aircraft Division was selected as a subcontractor for large and intricate assemblies for the F-86 as well as for North American Aviation's other high-performance aircraft, the F-100 and F-104.

These important assignments are typical of the way in which leading airplane manufacturers rely on Twin Coach as a source of major airplane assemblies.

If you have an assembly you're considering subcontracting, call Twin Coach for consultation. Our aircraft experience . . . our 23½ acres of plant and facilities are at your disposal.

OTHER DEVICES OF TWIN COACH COMPANY MAKE: Fuel-Vac and Fuel-Ejector Thrust, Fuel-Gasoline and Propene Engines, Fuel-Liquid Diesel Engines.



TWIN COACH COMPANY
Aircraft Division BUFFALO, N. Y.

TWIN COACH AIRCRAFT DIVISION MAKES ASSEMBLIES FOR BOEING, CESSNA, GRUMMAN, NORTH AMERICAN, REPUBLIC, AND CLASSIFIED EXPERIMENTAL AIRCRAFT TYPES.

AA-100



Twin Coach Aircraft Division plants turn out wing spars, main wing panels, fuselages, complete engine sections with plumbing and electrical wiring and other large assemblies.



HYDRAULIC RESEARCH's servo valve (left) drives attached control actuator. Moog multiport input servo valve (right) is in production for fighter applications.



Two New Servo Valves Integrate Automatic Control, Pilot's Input

Los Angeles—New concept in integration of automatic flight control and stabilization with pilot's manual input has been incorporated in two servo valves developed independently for high speed aircraft.

These units have been designed to provide:

- Improved control response.
- Increased simplicity in control actuator mechanisms, leading to increased reliability.
- Weight and space saving by elimination of separate control components and substitution of a single integrated package.

It is estimated that 20-40 lb. can

be saved by adoption of the integrated package to the three control axes—roll, yaw and pitch.

One of these units has been developed by Moog Valve Co., Inc., East Aurora, N. Y., and is in production for high-performance fighters.

Pilot Production

The other unit, developed by Bell Aircraft Corp., has been licensed for manufacture by the company's subsidiary, Hydraulic Research & Mfg. Co., Bethel, Calif. This unit, known as the Hydromat, is in pilot production. It also is for high-performance fighter applications.

Each unit is a multiple input electrohydraulic servo valve which receives electrical inputs from stabilization and autopilot amplifiers, as well as the manual input from the pilot's control stick.

Servo Valve Reaction

The servo valve reacts this way in the three distinct modes of operation:

- **Pilot's manual input** positions the valve spool, which in turn operates an electrohydraulic actuator to move the control surface. In performing this function, the servo valve acts as a conventional power control valve.
- **Autopilot control** is accomplished by introducing electrical signals from the airplane attitude reference system to an electrohydraulic amplifier. This links out the pilot's input and applies a precise servo the power control spool, which reacts the flow to the main surface actuator. Resulting surface movement provides the flight path control.
- **Autopilot stabilization** toward the capability of the pilot in high speed flight is accomplished by reception of an electrical signal from the rate gyro for the particular axis, superimposed on the pilot's manual control input.

The resulting hydraulic output from the servo valve provides the necessary damping in addition to the manual flight control.

Both the Moog and the Hydromat



Soviet Air Division Goes Home

Soviet-made MiG-21 fighters (foreground) and B-25 bombers (background) are being flown by Soviet pilots from Osnabrück to base in East Germany. Planes, belonging to 221st Soviet Air Division, were sent home as part of Soviet declassification campaign.

KIRKBY WEEK, September 17, 1954

The illustration is of a Mach 34 fully automatic ejection seat as supplied to Aerospace Division of Italy.

Research units use the electrohydraulic amplifier (hydraulic) to convert the static gyro-electric signal to hydraulic pressure.

Basic operational difference between the Mong and Hughes Research seats lies in the method of superimposing acceleration on the static gyro signal on the pilot's manual input.

In the Mong seat, acceleration is accomplished by adding, to the acceleration

displacement of the power control rapid-acting system, the movement generated by the static pressure from the electrohydraulic amplifiers.

In the Hughes Research seat, acceleration is accomplished by adding, to the hydraulic amplifier, the forces generated by the static gyro signal and the pilot's input motion.

Difference here between the two seats is simply one of design approach.



THIS Connolly Corp. Procedure Fitness, depicting Grumman's superior T100, teaches pilots how to react, cope with flame-outs, and breathe on them with the cockpit.

Naval Center Develops Training Devices for Use by Services

Port Washington, N. Y.—The growing importance of training devices in the military services is underscored by the recent statement made by a U. S. Navy fleet commander: "From now on I want a training device for every piece of equipment delivered to me."

To translate the commander's demand into practical hardware will become another task for the U. S. Naval Training Device Center which recently celebrated its tenth anniversary at its headquarters here in the modernized, six-story building of the former Guggenheim estate.

Training devices are beginning to hold an equally important place in civilian enterprises. For example, in Line Corp.'s plan to develop an electronic flight simulator for the Douglas DC-8 before the jet transport flies. This will mark the first time that a simulator has been available prior to the flight

of the aircraft which is designed to simulate—training the importance of having a training device at hand before placing a complicated new piece of hardware into operation.

The establishment, which held a few months ago was called the Special Devices Center (AW Sept. 18, 1955, p. 15), has the responsibility of developing—with industry—training units assigned by the five agencies responsible for all Navy training. The devices are used to train men who work and fight on the sea, on the air, under the sea and on land.

Although wholly about 100% of the devices developed here in the field of aviation, today approximately half of the center's funds go into water and subsurface training equipment while an increasing portion of production funds are provided for aviation equipment. The center also does

SQUIB SPECIALISTS



ELECTRIC PRIMERS

EXPLOSIVE POWER CARTRIDGES
GAS-GENERATING CARTRIDGES

McAllister
Company
1950-1951
and 1952

An important specialty in the design, development and manufacture of explosive devices, McAllister has long proven that explosive are dependable. The entire group is tested in a 40,000-psi test on a 100-ton test facility, perhaps the most complete facilities of its kind in existence.

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The ejection seat used by air forces of **26** nations.

MARTIN-BAKER AIRCRAFT COMPANY LIMITED

ENGLAND — CANADA



Business flies his way!

E. Hewitt (Andy) Anderson, Shell Aviation Dealer at General Mitchell Field, Milwaukee, has a knack for making friends and making money. Maybe that's because he keeps in busy.

Meet Andy Anderson—aircraft salesman. Andy first tried his hand at selling airplanes as a distributor for a popular airplane manufacturer and has consistently been on the "Top Ten" list of leading salesmen for this make.

Meet Andy Anderson—instructor in flying. When you love flying as much as Andy, it's only natural for you to pass on your enthusiasm. So Andy established a glider school and a student training center in Wisconsin plus a

primary flying school in Missouri to help hundreds of young pilots.

Meet Andy Anderson—flying ambassador. Andy goes everywhere in his own plane . . . signing up new clients . . . looking after all the Anderson interests.

Meet Andy Anderson—Shell Aviation Dealer. Andy's first big success was with Shell. His company, Anderson Air Activities at General Mitchell Field, Milwaukee, was formed in 1941. Today it's a round-the-clock operation, servicing four major airlines, an Air Force reserve unit, a National Guard squadron and a host of private and corporate planes.

And more and more business keeps flying

Andy's way. It's no wonder! He has a sure-fire sales-building approach—"Give 'em what they want . . . on-schedule service."

With a full line of Shell Aviation products in the shop, the very latest Shell equipment on the runways and the Shell Aviation Credit Card system to save the flier even more time, AAA is equipped to service anything that flies . . . quickly, efficiently.

For example, the daily routine includes preparing a giant airliner for a "cross-country hop" . . . getting a corporate flier off on schedule for an appointment in Cleveland . . . refueling Air Force jets for patrol duty . . . checking and servicing a private plane before it takes off on a weekend jaunt.

AAA has to keep up with the latest service methods, too. It depends upon frequent visits from the Shell aviation specialist plus merchandising hints in the Shell Dealer magazine to keep abreast of what's new in runway service.

Since he became a Shell Aviation Dealer, Andy has boosted his gallonsage almost three thousand per cent. No doubt about it—Andy Anderson sells for Shell and does a fine job. But Andy, himself, has said, "Shell sells for me!" And he can prove it.



With the latest Shell equipment on the runway, AAA goes down Air Force jets quick, efficient service.



Private fliers use the way AAA sells out like and expect to soon as they tell us.



AAA (Anderson Air Activities) helps major airlines meet split-second schedules with efficient, on-schedule service.



Dependable Shell aviation products in the shop help AAA do an A-1 job on repairs.

It pays to be a Shell Aviation Dealer
—and the Shell office nearest you will be glad to show you why





Rascal "no time over the target"

High in the atmosphere, a large U.S. Air Force bomber whisks. As it whisks, a long shape separates from the bomber. Rocket engine firing, the shape accelerates to high speed and reaches into the distance on an air-to-air missile on its way to a far-off target.

That, in brief, is the mission of the GAM-60 Rascal guided missile—designed, developed and produced for the U.S. Air Force by Bell Aircraft Corporation.

Rascal is a long range, air-to-surface missile which accomplishes its mission without exposing the bomber aircraft to concentrated local defense. Rascal can be launched and guided to its destination while the bomber is on its homeward flight, thus sparing aircraft and crewmen the critical "time over the target."

The guidance system which controls Rascal is close to human intelligence and operates just as if a pilot were riding in the nose of this missile. Rascal is propelled at its tremendous speeds by a rocket engine also developed by Bell.

Rascal encompasses one of the broad concepts of Air Force missile programming and Bell Aircraft has applied all the skills of its vast scientific and engineering team in the development of this strategic weapon system.

The Air Force industry team urgently needs scientific and engineering progress vital to the nation's defense. Opportunities to make important contributions are offered in military or civilian careers.

BELL
Aircraft Corp.
BUFFALO, N. Y.

ENGINEERING BULLETIN

ON MICRO BEARINGS
Miniature Instrument Ball Bearings

Subject: FACTORS TO CONSIDER IN MINATURE BEARING APPLICATION

TYPE OF BEARING

The Rotator Bearing Spool with the one-piece crown retainer is well suited for the great majority of instrument applications. Even ball spacing provides good performance at low-to-medium speeds, and it can also handle axial or thrust loads. Improved lubricating techniques result in crown retainers being specified for low-to-medium requirements.

Should Rotators machined from plastic plastic allow higher speeds and also provide some relaxation of lubricant. This retainer is used with regular contact, however, when it is used in a ground away from the main of outer ring to permit bearing assembly in such a tough plastic thrust only in the direction of the full load.

The Full Bearing has a full engagement of balls. If the rollers are closed on one side of each ring to allow assembly. This type of bearing is steadily being replaced by roller bearings which cost less in manufacturing and assembly. It has an advantage for certain applications requiring maximum reduced load capacity, but is unable to handle thrust loads because of possible interference between the balls and sliding surfaces. Contact between the balls causes friction which makes the full bearing unsuitable for low speed or high speed applications.

CROWN

ROLLER

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The Full Bearing has a full engagement of balls. If the rollers are closed on one side of each ring to allow assembly. This type of bearing is steadily being replaced by roller bearings which cost less in manufacturing and assembly. It has an advantage for certain applications requiring maximum reduced load capacity, but is unable to handle thrust loads because of possible interference between the balls and sliding surfaces. Contact between the balls causes friction which makes the full bearing unsuitable for low speed or high speed applications.

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The Full Bearing has a full engagement of balls. If the rollers are closed on one side of each ring to allow assembly. This type of bearing is steadily being replaced by roller bearings which cost less in manufacturing



RESEARCH WELDING for fabrication beyond the standard concept

For fabrication of graded metals, composites and atomic structures and for other technical projects, Research Welding is equipped to process experimental work requiring high-strength or corrosion-resistant alloys. Our hydrothermal and cold-chamber 1000 PSI metal forming, hot press and the latest automated welding equipment, Mass Spectrometer and beam testing, USAF-approved quality control procedures.

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NEW AVIATION PRODUCTS



Flowmeter Uses Ultrasonics

Ultrasonic energy is utilized to determine volume or mass of fluid passing through a smooth bore sensor. Simultaneous analysis of mass flow rate, mass turbulence, volumetric flow rate, volumetric turbulence and fluid density can be obtained. The device will handle up to 700,000 lb. or 90,000 gals. of jet fuel with an accuracy of 1%.

The sensor for a four-inch line is 10 in. long and weighs 16 lb. Massco Instruments Division, The W. L. Marston Corp., 4757 Austin Pl., Long Island City 1, N. Y.



Seal and Retainer

Zero leakage of liquid fittings is assured by rubber and metal action. It eliminates disadvantages of crimp washers, provides seal to total contact of fitting surfaces and is free of seal loss due to cold flow, corrosion or oxygen. The seal works with pressures beyond 5,000 psi against wet, oil or fuel and at temperatures from -65°F to 350°F. The seal will withstand intermittent temperatures to 500°F.

Franklin C. Walker Company, Inc., 18567 Jefferson Blvd., Culver City, Calif.

Drive Test Stand

Constant speed drive test stand uses electronically controlled variable speed motor to simulate variations of engine speed in flight and maintains an indication of constant speed drive from the established value. Tests in the operating range from 380 to 5700 rpm. Optional accessories include variable blower.



for generator and alternator, load bank, for alternator and generator, frequency meter to test drive stability and give cruise to constant speed, drive units weighing up to 500 lb.

Genco Hydrotech, Inc., New York International Airport, Jamaica 30, N. Y.

Automatic Cleaner

Small parts are cleaned, rinsed and dried in an automatic machine which can process 40 bushels per hour. Adjustable adaptable cleaning sequence.



uses hot recirculated cleaning solution spray, hot water rinse spray and drain dry. Hot air dryer may be added if required but latest heat air path is rejected to make direct driving solvents. Chips and foreign material are removed from working surfaces by chip basket. Solvent tank forms the base of the

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...and the U.S. Navy's Offshore Patrol that guards America

While you work, while you play, while you sleep—though any threat to your way of life be the farthest thing from your mind—the U. S. Navy is in action in the air along America's shores, protecting the peace you enjoy. This particular phase of Naval Aviation is the job of the Navy's "Offshore Patrol" . . . and Curtiss-Wright power is everywhere in the picture.

Curtiss-Wright Turbo Compound® powered Lockheed Super Constellation WV only winning ridge planes, and Lockheed Neptune P3V and Martin Mariner P3M long-range reconnaissance planes cruise far out to sea—day and night, over water. Cyclone 9-powered Grumman Tracker 5-1F sub hunters and Sikorsky HO4S helicopters range closer in, providing a light defense ring against enemies. Cyclone 7a power Vertol HUP helicopters, and Goodpasture CGP blimps with Curtiss Elcoma Propellers. The resultant "protection perimeter" extends from the Arctic Ocean south and the entire coastline.

These Curtiss-Wright aircraft engines—plus Curtiss-Wright jet and rocket power—are ready if exploding threats the coast. Meanwhile, they help you to work and play in confidence, sleep soundly.

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Which one will qualify as a missile engineer?

At least one—depending on three important points: The desire for a real engineering challenge. The ability to work with a top team of experts in their respective fields. The capacity to take on individual responsibility.

If this sounds like a lot, it's because North American Aviation has a lot to offer. With research, development and manufacturing responsibility for the U.S. Air Force SM-64 Navaho Intercontinental Missile, the scope of the air in North America is wide and the opportunity to assume a position of authority great. In fact, all phases of this project—research, design, development and testing—are being completed by North American engineers.

And what benefits will you find in this type of engineering environment? First of all—recognition that comes from the opportunity for individual effort. You will work with engineers who respect your opinions and professional status. Because missile engineering covers so many fields, you can work in the area of your choice. You will work on a team of specialists whose leadership in their fields will further you in the one you choose. You will live in Southern California and receive financial compensation tailored only by your own ability.

If you have the desire for a real engineering challenge—join us now.

Call Mr. M. Bennett, Missile Engineering Personnel Dept. 56-A KW, 12214 Lakeside Boulevard, Denver, Calif.

NORTH AMERICAN AVIATION, INC.



colored and contains photo rolls for testing of cleaning solution.

Raschall Inc., 3001 Ford Blvd., Hamilton, Ohio.

Hydraulic Valve for 1,500 Psi

Hydraulic valve for automatic use weighs about one-third pound and is designed for 1,500 psi working pressure. It features a sealed inlet valve without permitting hydraulic pressure of the system to be pumped up while the valve is closed.

Applications of the Model 4500 in check parking brake and telescopic air line valves in addition to pure water pressure controls. Unit meets MIL-C-7686.

Scott Aviation Corp., Lancaster, N. Y.

ALSO ON THE MARKET

Model 546 Laser Amplifier meets all requirements for amplifying accurate low and high level pulses at high data rates from scintillation detectors, scintillation chambers, and other radiation detectors. Measurements can be made of low Co^{60} X-Rays, peak to the process of a 1,200,000 counts Co^{60} (1 Hz, 1.33 mc/s). Background—Franklin Electronics Inc., East Fourth St., Bridgeport, Pa.

Heat reflective laminate, in combining properties of reflectivity of radiant energy with excellent characteristics of glass fabric reinforced plastic, affords a barrier to heat transfer at temperatures up to 1,200°. Additional advantages are weight savings and adaptability to molded designs—**Stordine Plastics Co.**, 6906 Blandin Blvd., Los Angeles, Calif.

Increasing motion, a linear solenoid is accurately controllable in the range of milliseconds. Employing magnetostrictive effect, activation of the solenoid electric motor influence of an electromagnetic field, snapping back to original size when magnetic field is de-energized—**Auronic Instruments Laboratory, Inc.**, 168 Oak Country Rd., Missouri N. Y.

Pierced Nylon self-lubricating insert, a nylon pellet encased in threaded portion of a screw, is now an optional feature at 80% standard, special and aircraft socket screw products. Insert eliminates need for after loading device—**Standard Thread Steel Co.**, Jacksonville, Pa.

Grade G 10 S65, glass-knee sheet laminate bonded with an epoxy resin, has low water absorption, low dielectric factor, and high bond strength, it meets MIL-P-15177. Material is available in sheet sizes of 36x67 in. with thickness

from .01 in. and can be supplied in a standard laminate or with copper foil on one or both sides for printed circuits—**National Vacuum Fiber Co.**, 1056 Birch St., Wilmington, Del.

Fluorinated monocrystalline optical waveguide combines two monolithic processing operations in one; makes hypocaust (12 in. x 14 in.) small chunks of fluorinated doped optical and mounting steps. Used in designed for use with all types of ends in which the apparatus designed to general U.S. Military specifications—**Fluorot Division of Davon Teller Co.**, 10 South Port St., Pearl River, N. Y.

Model LA200 10-ton, 1 in. diameter precision potentiometer has all steel central construction, metal bonded stops, stainless steel ball bearings, and glass sealed terminals—**Leitch Industries Corp.**, Components Division, 5871 Radco Rd., Los Angeles 16, Calif.

Model DVA-1, power supply and de-modulator unit, has been designed for use with 500 to 1000 test applications where 175 to 400 cycle single phase power is available. Unit will be under 7 1/2 in. high x 12 in. long, it weighs 11 lb.—**Delectron**, a Division of Minneapolis-Honeywell, 2400 Soldiers Field Rd., Boston Mass.



Turboprop transports with set records on



THE LOCKHEED YC-124B, powered by four Pratt & Whitney T-34 turboprop engines, is the world's fastest propeller-driven transport. The aircraft cruises at 489 mph.



A PRATT & WHITNEY AIRCRAFT T-34 turboprop engine is hoisted aboard a YC-97J Boeing Transport.

MATS COMMANDER Lt. General Joseph Smith cites the engine's record: "My Commanded Division reports that these power plants require considerably less maintenance than that required for any of our larger transport engines in common use. This remarkable record forecasts the fine service we can expect from the Douglas C-124A transports which will soon be at MATS operations." Pratt & Whitney Aircraft is most grateful for the magnificent accomplishments of MATS which are contributing very substantially to the success of the T-34.



T-34 engines MATS World Routes

6000-horsepower T-34s show their stamina in Boeing and Lockheed transports

The Military Air Transport Service is already using Pratt & Whitney Aircraft T-34 engines in Boeing YC-97Js and Lockheed YC-124Bs on its world routes. This engine also powers the Douglas C-124A, the highest payload production transport ever to go into service.

The outstanding service performance of the T-34 engine is another example of Pratt & Whitney Aircraft's continuing leadership in design, development and production of dependable engines.

New records include—

- A Lockheed YC-124B flight from over Gander, Newfoundland, to Aberdeen, Ireland, in 4 hours and 13 minutes.
- Boeing YC-97J round trips from Texas to Germany and Japan, the first turboprop transport flights across both Atlantic and Pacific.
- A new in-service MATS record, set when two YC-97Js flew a total of 66 hours and 35 minutes during a single 24-hour period.



EACH BOEING YC-97J has accumulated over 1000 flight hours and their engines are already operating over 500 hours between overhauls. These aircraft have maintained 8.1 hours daily utilization during a single month, demonstrating the reliability of the airframe, propeller, engine combination.

PRATT & WHITNEY AIRCRAFT

Division of United Aircraft Corporation • Main Office and Plant: East Hartford, Connecticut
Branch Plants: North Haven—Scituate—Meriden



AERODYNAMICS hypersonic test vehicle.

National Aircraft Show Displays



F-8H - highly pod carries three Falcon missiles and 20 2.75 in. rockets.



T-60 Model 51 primary trainer experimental airplane was shown at Oklahoma City. Navy has ordered evaluation quickly.



PILOTS demonstrate accuracy of Cassin V-37 engine.



WHEN V-37 (first alternate shown) opens...



JET INTAKE screen retreats back with fuselage when gas is up full water on top operator intrinsically to aerial buffing.

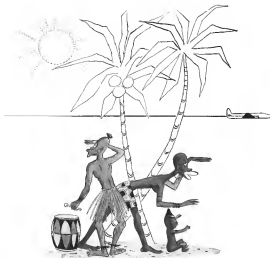


... IT DEPARTS jet blast alternately 40-60% of blast. Control system also exits again plus before 70% of power.



FORWARD portion of Cassin V-37 engine (top right) illustrates speed reduction, lubrication systems in Cassin V-37 engine. Below two single pylons mount (bottom).





Around the equator 1,500,000 times!

Passengers on the scheduled air fleets of the world last year logged 55 billion miles—enough for two passengers to fly around the equator a million and a half times! This figure represents a gain of 15% over total passenger miles flown in 1954. And this amazing record is expected to be broken again in 1956.

As more and more people fly more and more miles, new and better planes are being developed

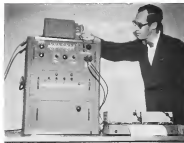
to serve them. To keep these planes flying, operators know they can rely on Esso Markets for the best in modern aviation fuels and lubricants—perfected through years of research—and for the finest in uniform, safe and efficient petroleum service along the airways of the world



AVIATION PRODUCTS

8 OUT OF 10 OF ALL THE WORLD'S INTERNATIONAL AIRLINES USE

BUSINESS FLYING



HYCON COMPUTER (left) is used to process geophysical data rapidly and present finished photographic maps without long delays. A plane in one hour often collects enough data to keep the Hycon office busy for about 100 hr. Photo (see right) of A-1 H, World War II. As Tombs handles and compares, knows, prepares the photo contains with Hycon-developed camera and map study. Hycon is pioneering development of color color photography with its own computer control, developing methods.



Aerial Surveys Grow on Speed, Savings

By Bonnie Long

Pasadena, Calif.—Mining, oil, lumber and other firms seeking quick and accurate mapping and exploratory services are looking to the aerial survey industry to locate their claims a year. One of the key firms is Hycon Aerial Surveys, Inc., jointly owned by two companies which develop much of the

component of tech. Vision Associates of Eden, Calif., provides many of the electronic devices and Hycon Mfg. Co., through its camera and instrument divisions, produces much of the photo equipment.

Although headquartered in Pasadena, Hycon Aerial also maintains laboratory facilities and offices in Washington, D. C., Dayton, Ohio, and Honolulu,

Holy, and sales offices in Santiago, Chile, Lima, Peru, and Quito, Ecuador.

Proved economy, both in time and money, is the big reason for aerial survey popularity. Hycon points out that an aerial survey done in 1954 and one half years ago cost \$66,800 was saved as a project to determine whether a road would go around or through a swampy area.

If asked by ground survey methods, it would take approximately three years and cost about \$100,000, but as it required six months and only \$19,912.

Techniques Offered

Services and techniques offered by the company include photogrammetric engineering; photographic and geophysical aerial surveys; photo geologic evaluation; and photometric control, and topographic maps.

Demanded for aerial surveys is world wide and Hycon is equipped to handle both domestic and foreign expeditions in such fields as geology, forestry, and conservation, petroleum, mining, high seas, national traffic, utilities, port lands, transportation lines, tourism, bombing, flood control, city planning, land evidence, water resources and wild life activities. Soon to be introduced are



RED USED to detect air deposits. Red contains two sensitive coils each tuned to one of the transmitted frequencies, making it possible to test a 100 ft swath beneath the plane.

LIQUID ENGINE DIVISION



In piston engines, turbines, and other propulsion systems, Aérojet General liquid-propelled rockets have proven excellent for needed thrust, performance, and a proven power path.



Whether your client has in Vanguard or views Aérojet General the wide variety of engineering capabilities for:

Mechanical Engineers
Electrical Engineers
Chemical Engineers
Civil Engineers
Aeronautical Engineers
Civil Engineers
Metallurgists
Chemists
Physicists
Mathematicians



Write, Director of Scientific and Technical Personnel, Box 2344, Alhambra, Calif. or Box 1907, Santa Ana, Calif.



PBY WHICH SERVES is flying from geophysical laboratory drawing horizontal loop which demands an electromagnetic field. Radio-like structure (left, below) is detector or "bird" which picks up signal indicating position of ore deposits. Flies the coast of new spotting stands to record flight path.

actual power in helicopter, furthering Brown's already wide potential.

Underway is a test program using a Bell 470-1 equipped with magnetometer, electromagnetometer and aerial transfer propulsion to starting down the coastward coast, this fall.

Geophysical exploration can be done, too, from a helicopter and aircraft, more rapidly than a helicopter than from ground service," said Brown's Geophysical Unit Director. Some of the largest mines are located on the plots of land of only 200 acres in the roughest terrain, the company's helicopter action will enable detailed surveys to be made over some too small to be economically feasible for land-roving exploration.

Aircraft Requirements

Aircraft requirements vary with the detailed fields of service. World War II surplus planes, supplemented with current Brown and Beechcraft models, are in use.

They are selected for their operational qualities. A P-18, for instance, is suitable for certain types of mapping of high terrain requiring altitudes up to 30,000 ft. At present, Brown's fleet consists of 12 planes, four Cessna 79's, one Beechcraft AT-11, one Beechcraft Bonanza and five P-18's.

With as one to the future Brown is:

- Introducing helicopter aerial transfer, thus detection devices on a single flight.
- Developing aerial color photography techniques for spotting mineral deposits and for forest evaluation.
- Using a light-weight stage motion

magnetometer system which projects aerial photography from a small, single engine plane. This, for the first time, makes low altitude photography that are not blurred.

These electronic devices which have contributed so much to aerial surveying are the magnetometer, electromagnetometer and aerobrometer.

Magnetometer searches out large mineral deposits by sensing the deviations this produces in the earth's magnetic field. It has been used to locate, and is now being used to locate, iron, gold and coal. It also geologists find structures which can contain oil. The helicopter version of the magnetometer, through careful engineering, will weigh only 50 lb.

Electromagnetometer projects the mineral deposits which are electrical conductors. It is sensitive enough to detect shale or bodies that contain copper, lead and nickel. The device sets up a large magnetic field in sending an electric current through a wire and back around the plane, thus creating the disturbance induced in the field is electrical conduction in the earth.

Turning a lead electromagnetometer circuit containing two sensitive coils each tuned to one of the unwanted frequencies makes it possible to hit a 40-ft. north beneath the aircraft. Helicopter version will consist both in plane and out of plane components of the field in a diameter of 4,000 yards. The helicopter unit has completed 2,000 hrs. of test flying over known ore bodies in Canada with excellent results according to Brown. Developed by Aerogeophysical Services,



s'Gravesande's Steamwagen

s'Gravesande's Steam Reaction Car

In 1725 Jacob Willem s'Gravesande of Delft, stimulated by the recently announced Third Law of Motion, astounded the Royal Society by propulsion a practical steam reaction car.

The vehicle actually moved several times its own length, a distance of about two meters.

In 1956 the goal is no longer meters, but hundreds, and even thousands, of miles. Aerojet-General Corporation, leader in American rocket propulsion for more than a decade, is proud to participate in man's first assault on the frontiers of outer space—Project Vanguard.



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Aerojet-General invites scientists and engineers—men of imagination and vision—to join the attack on the most significant research, development and production problems of our time.

When it comes to trench tube connections, it pays to specify Weatherhead MS Slip-on tube fittings. The standard for new on-cloth and on-site design, America's Number One source, Weatherhead alone gives you the benefit of many years in generating, developing, and testing these fittings to meet the highest standards of the U.S. Air Force and U.S. Navy. And only Weatherhead manufactures the tools and techniques for pre-setting MS sleeves—key to speedy production assembly with the positive high pressure sealing advantages now in universal demand.

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- Application consulting
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 From CLEVELAND on ROUTE 207, TURN OFF ON E. 121st STREET, LOOK EAST



Seventy-meter detritus traps, subject to leach. The multiple channel ventilation counter provides, after water data collection, precise information on total field genus radiance information on the spectrum of the radiance per unit identification of the fauna at

of the massive forest very small "timber cruising" with the aerial camera is another Hi-con service. Late and photographs distinguish hard wood from soft wood growth. When color photographs is coupled with stereo plotting map making techniques, controlled geologic maps can be turned out without a geologist sitting first on the ground.

This accounts for a large portion of the aerial survey business because oil and mining companies now are willing to spend money to get a preliminary evaluation study before they spend staggering sums for actual detailed ground geophysical and drilling programs. The modern criterion is exploration: does the 'chick' fit a bird's eye look? with modern geophysical and photogeometric techniques before embarking on a full program.

It also is promoting the development

of color, photographic, and to date, less over 100,000 sq. mi. of successful results. With careful temperature control, pairs, of developing solvents and other developments in common methods this new step in mineral recovery could show great oil companies a real solution to an acidic variation in the rock color. Mining companies find spotting the vivid black and green colors of copper deposits and the vivid green, yellow of the various carbonate minerals.



doors and provide easy movement around the cables or other parts of the plane being repaired. And mechanics can take all their tools with them as dramas running up and down.

Atlantic Aviation Service uses several types of Polygram work platforms, either singly or grouped together so that a number of service men can work at the same time. They find them particularly effective for engine repairs, painting, putting on new coats on wings and tender jobs.



BALLYMORE
PLATFORMS



Sprints from deck to stratosphere

His test is the acme of the world. His job, to challenge unknown intruders in one defense perimeter. A Navy pilot is a seagating sassy on 24-hour duty.

A major role is his job of positive interception—and to be first on the scene as possible. As being assigned to the Douglas F4D Skyray. Less than a minute after leaving the deck, Skyray can soar past the 10,000-ft mark. Seconds later it's heading through the atmosphere . . . 32,000 feet up . . . in the stratosphere with rockets and ordnance.

This rate of climb costs as no surprise. Skyray also holds the world's official F-4 I sea level speed records for the 3- and 100-kilometre courses.



Douglas F4D Skyray—fastest career-based interceptor. Performance of agile Skyray continues the Douglas tradition of "more and better with a bigger payload." Yet performance figures are meaningless without a skilled pilot at the controls. If you are interested in a career as a Naval Aviator, visit Nav God, Washington, D. C.



Depend on **DOUGLAS**

First in Aviation



Bell Ranger Makes Sales Tour in South America

At least 17 major sales demonstrations at 35 Central and South America countries are planned for new four-place Bell 47B Ranger utility helicopter. Piloted by Joe Maloney, assistant director of contracts, the Ranger left Bell's Ft. Worth, Tex., Helicopter Division at maximum gross weight of 3,565 lbs., including conversion kits that quickly adapt the aircraft for specialized missions and extra fuel. Cities for a quick review, pointing up its versatile transport role. The Ranger demonstrates a capacity to return to the factory in November.

agencies of foreign governments are of local place at a cost of about \$100 per sq. mi.

Bell's current sales backlog at over \$3,185,000 includes projects for the U. S. Army, Map Service, Republic of Chile, Colombia, Santo Domingo of the Dominican Republic, and other countries in South America, the Caribbean and Alaska.

Germans Will Open Private Air School

Boen-Start and other private aviation school in Germany will open at Frankfurt Obf. 1 under the name Luftfahrtberufliche An- und Fortbildungsschule für die Zeile Luftfahrt. The school will not be permitted for all branches of civil aviation.

As a result of the shortage of trained aviation personnel, the civil aviation has granted full assistance to the school. Training personnel will assist research, all forms and present and aviation experts. Aviation will also available personnel and facilities for the practical part of the training.

Miami Firm Converts Three Cessna T50s

Miami-Air Corporation of Miami has completed the conversion of three Cessna T50 aircraft for a Cuban carrier.

Seating reports of the helmsman good planes has boosted from five to ten and a lounge installed. Because of the major passenger seats makes

possible the quiet, conversion of the Cessna to flight carrier.

Replacement of the aircraft, 225 sq. ft. Jacobs engine with 160 hp. Lucas engine has replaced the three-blade propeller, according to Air Corporation. The firm has performed previous conversion of the same airplane for various users.

PRIVATE LINES

Notes-rod from line lightplaces at the same cost as a new cord. Equipment can be brought in from the United States or other countries. The new line replaces the firm's own cord line. Initial available size is 100 x 6 with length 100 ft. and weight 11.00 x 12. Right additional size 1/2 ft. placed in the market soon.

And for outstanding construction to agricultural systems in 1975 was presented to C. J. (Jack) Rose, Co. President, North Corp., president, by National Association of Farm Bureau of their national convention.

Scholarship \$500, recently delivered to Oshington, Scholastic, Ltd., will very pleasure the firm's for \$50 in engineering operations to defense establishments in northeastern Canada.

Two Cessna T50s have been topped with the new Federal into pilot in Pacific Aerospace Corp. to demonstrate the approach to find base operations and aircraft delivery in a 15-state area in the West and Middle West. The helicopter outpicks with \$1,999 in the single-engine version and about \$2,500 for the two-engine model (Aero. Apr. 22, p. 145).

Helicopter is used by a Detroit, Mich., and estate organizations to give prospective home-owners an aerial view of the new housing developments.



PORTABLE LIGHT can be used for finding and two illuminations, having a 100-watt, version in other directions and about 120-deg. extendable out. Lightpoint with prism control of illumination like a spotlight. Lamp is 400 watts. Make at light Cessna Manufacturing Co., Elyria, Ohio, was the C-2501 light as its Rock D15 and Cessna 110 become planes.



AVIATION WEEK

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British Court of Inquiry Report:

Crash Crews Avert Fire in York Crash

On the morning of April 18, 1956, a York aircraft G-VNUL (serially called "Duck Lane") was due to take off from Stansted Airport in Essex on a flight via Malta to Johannesburg in May. The aircraft was owned and operated by British Overseas Airways (BOA) Ltd and the flight was being made on charter by the airline, in order to ferry four passengers and their baggage to the airport. The passengers consisted of 14 of whom 12 were children between the ages of 2 and 10, and between them were two babies. The aircraft carried a crew of five and five fuel for the flight.

Shortly after 0930 GMT in perfect visibility conditions "Duck Lane" started on its take off run piloted by Capt. W. L. Wilson with the assistance of First Officer Upthorpe. After traveling 360 yd. along the temporary runway then to an old Stansted Airport the aircraft developed a rolling motion with a consequent shuddering movement of the firm so severe that within a further distance of less than 150 yd. it left the runway on the airfield side and under the influence of the strong, gusting and howling at about 41 ft.

On reaching a French dune 15 ft from the runway, the firm struck and upon the undercarriage was rock that it hit, the aircraft rolled over and the engine failed. The aircraft struck on its belly and on the port side, which was the side of the fuselage. The aircraft struck a few yards further, still swinging to starboard, and then came to rest on its side, about 100 yd. from the runway. The aircraft was then in the direction from which it had begun its run.

Two Killed

The effect of the entry into the base of the post which was to knock up and dent the seats immediately adjacent to the point of entry, falling on the main and a forward seat and suffering severe injury to two other passengers. Due to the belly of the aircraft, it was rolled over to starboard and the fuselage was then on its side. The aircraft was then on its side and the fuselage was then on its side. The aircraft was then on its side and the fuselage was then on its side.

It will be evident from the circumstances described that the danger of fire was acute. Although the airport fire brigade was at the scene immediately within a few seconds of the aircraft coming to rest and it had a number of men on duty so that the risk of fire was averted. The fire and the smoke caused passengers considerable loss of life and the aircraft was then on its side and the fuselage was then on its side.

In order to examine the causes and circumstances of the accident and to ensure the greatest safety to the public, it is necessary to consider fully the report and in particular the construction both of the aircraft and the French dune on which it crashed.

Initially I proceed to consider the stability of the aircraft and whether the accident is attributable to any mechanical failure, and finally the landing of the aircraft by Captain Wilson. After discussing these three subjects and giving my reasons to the greatest extent I then thought it desirable to deal with a complaint made by a passenger in regard to the safety belts provided on the aircraft and to describe with some further detail the action taken after the aircraft came to rest both to avert fire and to free the injured. Finally I came to make a recommendation with regard to the French dune.

STANSTED AIRPORT

• Runway

Stansted Airport is the property of the Ministry of Transport & Civil Aviation and is used as a base by several aircraft companies including British Overseas Airways (BOA) Ltd and also by the U. S. Air Force. The runway of the airport has been 990 yd to 250 yd long and is 100 ft wide. It is a grass runway and is 100 ft wide. It is a grass runway and is 100 ft wide. It is a grass runway and is 100 ft wide.

The runway was 100 ft wide and was 100 ft wide. It was 100 ft wide and was 100 ft wide. It was 100 ft wide and was 100 ft wide. It was 100 ft wide and was 100 ft wide. It was 100 ft wide and was 100 ft wide. It was 100 ft wide and was 100 ft wide.

runway by spikes at intervals along either side and connected by rubber tubing.

These lights are fixed at a distance of 10 ft. In front the outer edge of each shoulder is marked by the middle of the runway between the lights at 528 ft. A broken white line marks the middle of the runway throughout its length and there is also a continuous white line painted on either side of the junction of the old runway and the shoulder.

The runway is considerably narrower than an aircraft of the size of a York, which has a wing span of 141 ft and a wheel base of just under 24 ft. A plane taking off a York from the runway would naturally tend to avoid hitting the wheels on either side of the runway although, if he did, it would support the weight on it supported that of "Duck Lane" on the runway on the ground. If he hit any of the lights it would be most unlikely to cause the aircraft the slightest damage.

Although absolutely narrow for an aircraft of the size, there is no doubt that the temporary runway is satisfactory. It has in fact been used successfully by York and other aircraft of comparable size since July 1, 1951, and I am satisfied that with proper skill and care no experienced pilot should have found difficulty in taking a York safely onto the air field on the runway in the perfect weather conditions experienced on the morning of the accident.

Capt. Wilson himself had pilot of York aircraft from the runway without difficulty on at least two previous occasions and stated in the course of his evidence when asked whether he was at all troubled as the runway by the width of the runway that he was not conscious of any undue narrowness.

• French dune

On the north side of the temporary runway and 15 ft from the outer edge of the shoulder a dune of the type called a French dune had formed in the middle of the runway. It was 100 ft wide and was 100 ft wide. It was 100 ft wide and was 100 ft wide. It was 100 ft wide and was 100 ft wide.

The dune was 100 ft wide and was 100 ft wide. It was 100 ft wide and was 100 ft wide. It was 100 ft wide and was 100 ft wide. It was 100 ft wide and was 100 ft wide. It was 100 ft wide and was 100 ft wide.



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bottom of which a porous (foam) pipe has been laid so as to catch any fuel that leaks above the pipe, thus thus avoid a fuel leak that could ignite—pipes and pieces of low center—which could not pass through seals, and to select the Class C allowed parts of materials employed to form the base of the chamber.

Any attempt to test or seal the filling might result in breaking the pipe and in consequence it was necessary to leave the filling some inches "proud" to allow for settlement as the top up from time to time is settlement allowed. In fact the filling was left "proud" and was that a case for liquid used, the work was done, it is in some places at least 4 in. "proud" and the doors at the top are large, and sealed to prevent the loss (explained by M. M. Johnston, General) could in some cases be described as small leakage.

The door below is now closed at the point where the gas escaping from the outer edge of the chamber makes a dip with the slightly more proud further to the south. It is a very slight dip, and at a point where damage is obviously necessary both for the ground work of the main and in order to fill area, surface water from the main and water which might otherwise accumulate below the chamber.

I was told and I accept that this type of door around with standard practice in many fields and that although it is possible to fill the top layer of the tank with open material or left and left, loose stones are generally preferable from the point of view of clearing, and especially in heavy clay soil such as that at Stewart. Mr. Johnston, deputy director of Works at the Air Ministry, stated that as the rate of a dump of the soil sufficient to fill the area was so, he suggested Mr. Glen Douglas, a senior investigating officer of the Accident Investigation Branch at the Ministry of Transport & Civil to show against the opinion that if the aircraft had not the door at right angles while moving straight it would have poured over it without damage. It is obvious that the door was left somewhat over "proud" and that consideration must be given to the size of the doors used to fill it. Did these particular factors have any real effect on the accident in question?

Visit to Airport

In the course of the survey, I visited the airport and was able to examine the track left by the aircraft as it ran and the runway and below it, met the door.

The large aircraft was moving rapidly to the south and the runway south of the track left by the two and the rapid running of the doors. However there were some damaged the main chamber area, most and the chamber dropped it down of the preponderant lateral status put upon the aircraft. I am satisfied that the damage occurred in this manner when the aircraft met the line of the door, due to the rubbing action to which the hole was subjected caused the underrunning to collapse.

Evidence was put before me which I accept, that any sudden change of surface angle in these very narrow circumstances, had produced a similar effect and control

that of the aircraft had not a random factor, instead of the line shown at the diagram, the main, a hole, a hole, followed. Made a man should live on either side as a sign, all gas left enough to cause, that as a result having the runway to see, however, circumstances will be able to see in cases supported by my aircraft. In practice, this is impossible.

First, the door was a type which appears to me to be undetectable and in accordance with standard practice, it was properly used and necessary and I do not think that the fact that some reference may be made of the runway of filling made not a difference in the particular case, although I have thought it right to refer to this subject in making my statement at the conclusion of this report.

The aircraft left the main in a most unusual circumstance and I do not think that this, for what occurred on it, put upon the door. If this accident had occurred in a wet condition and there had been no snow so that the ground was waterlogged a similar result would have occurred. If on this occasion it had been to put instead of to maintain there were many other factors, such as the runway which was, in part, to be noted, with which it might have collided as well as in some and level standing which would have had a similar effect.

THE AIRCRAFT

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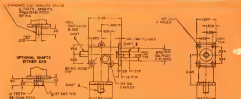
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TIME ELAPSED

so the effectiveness of the rider will gradually increase.

Capt. Jones' evidence was that the head up. Uncle Louis, at the threshold of the room, standing the white line, pointing 5 deg to the left of 2. He stands not forward a yard or so, as you think that but not what was straight. This evidence is contradicted and I am satisfied that the exact one properly head up. I am not sure to live up a York exactly and although in view of its tendency to travel to the left it is better to avoid any inclination as that direction is caused by displacement 5 deg, as well within the limits of tolerance. Most serious that the sound of the first check is raised particularly because "Uncle Louis" moved last word.

What happened thereafter is described by Capt. Wilson and his shipmates in regard to the latter part of the aircraft's course can be checked with the track left by the wheels and subsequently plotted on a map. Capt. Wilson's account was as follows:

It starts in "Uncle Love's" movie slightly to the left. I reversed the side of me. The screen seemed to come straight. Then I felt a violent sting to the right. I did not like it. I pulled everything (because the theater looks off and out) around on. The screen seemed to roll. I felt well. When I had got my hands off the theater, I was preparing to see control of the screen to pull the screen up. The screen seemed to roll off. The new thing was more off in a 180 deg. turn. Then of course we set down.

Capt. Wilson was aware that he had not at one time used his bullets but thought that he might have used his rubber mace-tooth. When he closed the chest he did to become he had decided to abandon the take-off run as rich of the strong which had developed.

...told what could have been the cause
of the violent swing to starboard he said
I cannot think of any myself! The only
possible thing I could think of was that I
must have somehow and converted I would
like the Clerk to tell me.

He added that he was "not conscious of having compromised" and that at the time, he closed the theatrics, which was before the aircraft crossed the center line. He thought his speed was "fast enough to clear obstacle but not too fast to get on of it."

First Officer Upchurch's account was that as "Dark Love" left the dashboard he had his hand down watching the instruments. He said:

I was aware he was, according to the left of the center line—a definitely was not a wing in any way but a right arm, more to the left of the center line. The most persons were at the time, 1-16-18, approximately, I put my left hand up to Capt. W. D. W. right hand I anticipated taking over from him and had my hand I took on the theatre and I felt him using differential thrust and still pushing some them and I looked up to see why. I saw that we were on the left hand side of the runway—slightly on the left hand side. I would not know how much but enough to

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left. The Captain pulled the throttle back and put his right hand on the control column. Almost immediately I pulled back the throttle—the jet didn't because it was not fully closed.

He went on to describe the unusual amount of the wing and the engine, and stated that the port outer ducts were shut as much as half open when he brought the jet back to full power. When he brought the jet back to full power, he said, he knew the jet was not fully closed. He was not sure after putting up his left hand that Captain Wilson was not violent or a violent movement of the ducts.

In relation to the evidence of Captain Wilson and First Officer Upgren, I had the case from other members of the crew and from various witnesses. A body of

evidence corroborated that of Captain Wilson and First Officer Upgren in the effect that the aircraft initially followed a normal climb, slightly to the left of the center line. Somewhere above the point where the two ducts were first closed, Capt. Wilson must have taken action to correct his course, to put and keep the aircraft straight. Captain Wilson is not someone that the commander has first made any other than a normal one, and a corrected climb, he did not touch the brakes.

It was observed from the track of his feet that the initial take-off was that of the standard climb and that at that point the width of the track is over 24 ft and accordingly some feet wider than the normal track width of 21 to 22 ft.

Although the width was so great that this

was that in a balance, of some inches, the track of the track and the fact that the starboard wheel track is the first to appear on the ground support track.

"Grave Error"

I cannot think, in the light of the evidence that there would have developed without some gross error on the part of Capt. Wilson as indicated by his own testimony. This matter being as so early a stage of the accident it can only result from a correction of the standard climb, either by a sudden and excessive deflection of the throttles or to a momentary application of brake to the starboard wheel or to both this, Captain Wilson is not someone that he did either of those things. I have no doubt that he experienced trouble and emergency when he used the throttles in taking the aircraft straight and that this caused the beginning of the crash.

In the light of the starboard wheel track and the fact that he was in the area, I am inclined to think that he must at the same time have applied the starboard brake. The latter appearance occurred upon take-off, but nothing else will in any opinion account for the sudden development of so severe a crash that even before he could get the center line he decided to close the throttles and to abandon the take-off. The fact that in closing the throttles he left the port outer open would, since it had been at that time, serve to contribute the more to the effect of the error was quickly corrected by First Officer Upgren.

It is difficult without experiencing the richness of the scene as Capt. Wilson did to attempt to judge whether his decision to close the throttles and to abandon the take-off was the right decision. Equally, it is not easy to estimate what he did or failed to do after he had closed the throttles. In the latter stages of the crash one of the most difficult things to understand his course and emergency pilot who gave evidence against the opinion that it was better at that time to see the field.

In these circumstances I am not prepared to condemn Captain Wilson's decision in the light of the evidence. It is not possible to control the course of the aircraft. The error was committed earlier when he started to correct his ground error. My opinion is the evidence added by the Airframe Council is accordingly.

Question 1. Did the aircraft have a valid Certificate of Airworthiness and did it have a current Certificate of Airworthiness at the time of the accident?

Answer 1. Yes.

Question 2. What was the cause of the accident?

Answer 2. An over-reaction of the portward course of the aircraft possibly as compared to some application of the starboard brake, causing the aircraft to swing to starboard off the runway and to cause the jet to crash down with the resulting failure of the engine.

Question 3. Was the accident caused or contributed to by the negligence of any person or party?

Answer 3. It is against the evidence that the jet was not a pilot, whether or not it is compared by some application of the



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Company Omitted

Your August 6 issue of *Aerospace Week* contains a very interesting and complete coverage of the Air Research and Development Command.

I can appreciate the editorial problems in selecting and editing all the relevant items from the various test facilities, and I think you have done a excellent job. I realize it is impossible to do an understanding of the type to obtain complete and accurate information from all the test bases. However, we were very disappointed in your coverage of Edwards Air Force Base in which you omitted its major programs in their Data Research, before being developed under Project Defense without mentioning that the Electronic Engineering Company of California is the prime contractor of the development of the entire project.

Your article mentioned various technicians who have participated in the project and have made valuable contributions. The Electronic Engineering Co. has the overall responsibility for the design, installation and evaluation of the system, and has developed a number of major systems components in addition to those listed in your article.

We feel that the Air Force personnel at Edwards Air Force Base responsible for the system and the development of it to be distinguished for their strength in having acquired the expertise project.

Although there are other automatic or non-automatic processing systems at other government facilities, we believe that the system at Edwards Air Force Base, when completed and in full operation, will represent one of the most integrated and advanced systems to date.

R. E. BARNARD, Vice President
Electronic Engineering Company of Calif.,
Los Angeles, Calif.

Job Change Reply

The letter written by Prof. C. Steinbock (AW Aug. 20, p. 114) was very interesting to me and as I am probably one of that group of engineers who are not working, I should like to post a few questions for Mr. Steinbock's consideration. I am assuming we are not speaking of an experienced engineer, but of a college senior. Mr. Steinbock states that the engineers he refers to have a job after job listed of a year or two duration, such temporary job giving a \$12,000 to \$15,000.

The first question that comes to my mind is whether Mr. Steinbock feels that there is something unusual about the work of a company that requires a permanent two-year term period whereas other companies would not require such an extensive period of time. I would like to know what time of his letter I would assume he does not feel his company has no reason on its own behalf.

On the other hand, I think it is a pity that a company which has an engineer in its employ, who has completed the period of enlistment and is ready to carry his own weight, can not afford to pay him

Aerospace Week understands the position of its readers on the matter raised by the engineer's editorial comment. However, letters to the Editor, *Aerospace Week*, 120 E. 42nd St., New York 17, N. Y. will be accepted for consideration and given a previous identification. We will not print anonymous letters, but we will print letters which are so identified on request.

engineer a better salary than would a second engineer, which presumably would also provide a twelve-month period of two years before it will make its commitment.

Finally, I would like to know how Mr. Steinbock himself has converted that good engineer will require two years enlistment two before he comes to his own right.

It is my own feeling that five years is at the end of which of the double facilities among engineers today. This conclusion seems to be based by many people on old regulations, which in the fiscal length of enlistment required may vary from one process or company to the next. However, these considerations are necessary, but I think that in most cases it is the best plan engaged by those who make the job impossible.

Finally, it is a company being free to itself as to which kind of engineer it pays less money than it is worth to the company in order to enter into a new firm some other engineer? An engineer who has been hired at an increase in salary doesn't expect to wait for two years before he is given a promotion of the same steps as he had on the job he left. He expects, after a reasonable period of enlistment, to be given responsibility commensurate with his salary and experience.

Furthermore, it would not seem unreasonable for him to expect to continue to receive components of normal compensation (and compensation) as his experience grows and he becomes more valuable to the company.

I don't pretend to be a personal expert but consider the idea that an engineer that remains for several years is substantially the same as that at which he was hired in order that the company may ensure the training investment does not seem to be a particularly sound policy. The training in current line of research requires him to seem like a commitment very to lead all a new rather than a basic line exploration of company policy.

CLARE D. STEINBOCK
Baltimore, Md.

Engineer's Advice

Just finished reading the second letter on p. 145 of your July 16th issue and would like to add the following.

It would like to point out that I did not read the article "Douglas Engineer" (AW June 11, p. 145)—however, from reading the mentioned letter, this article must have concerned salary and advancement in position.

As it happens, the firm I am employed by has been trying several years to hire one or two engineers. These attempts have been

made by applying to several engineering schools and through ads in the papers. Recently, the firm I work for rather suddenly requires about 100 people. A lot of decent middle management work and machinery is manufactured. The firm has been in business 40 years.

It is not that they couldn't make find the firm is small and not one needs a glamorous name for new engineers being graduated from complete schools. Finally, these young people just being graduated seem to find they fill in the \$5,000 to \$10,000 salary bracket. They are interested but in what benefits the company may offer. That takes care of some engineers.

Now those remaining need are on nearly satisfactory in salaries who want from \$15,000 to \$25,000.

There are thousands of small firms just like our all in need of engineering aid. However, they cannot compete with large government supported firms and many will "die on the vine" due to the lack of this engineering aid.

It is my belief that there is most opportunity for advancement and also greater chance of better living problems with these small firms than there ever will be with these large government supported organizations.

Further, it would be better if these engineers and so-called engineers take stock of themselves and grow closer to earth with their ideas, demands—the "homework" definitely will be over soon.

JOHN D. JOHNSON
Wichita Falls, Texas
Retired, Ill.

'Crash Boondoggle'

The editorial, "Crash Lovers Say Safety Record" was excellent (AW Aug. 13, p. 21).

The reason of the late Congressmen who participated in the Las Vegas boondoggle to "investigate" the United States national should be grateful to provide a ride once but for voters in the coming elections.

K. H. WILKINSON
General Electric Co.
Johnson City, N. Y.

Battled for Progress

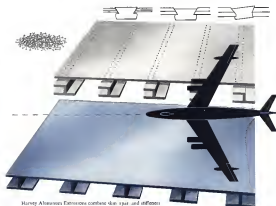
Congratulations on your editorial, "We Are All to Blame," at the third state of American Union.

When the Senate Criminal Justice was out of the people's club and the law was not successful in the battle against progress against to combat new this year—well, he was removed.

It is deplorable that he not represent and good judgment cannot be obtained more than in the present circumstances to on public plans for remedying the criminal act.

MURRAY C. MILES
The House Corporation
Chicago 6, Illinois

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With full load, the C-130 takes off and climbs to 2,500 feet in 60 seconds — a remarkable feat for a large transport. The Hercules has a flexible flight envelope in that

it has the ability to fly at low altitudes for airdrops of personnel and equipment and yet has a high-altitude range of 40,000 feet.

Product of a 5-year joint effort by the Air Force, Allison and Lockheed Aircraft, the C-130 is being produced in quantity by Lockheed's Marietta, Ga., plant. These high-performance Turbo-Prop transports will begin joining the Tactical Air Command late this year.

ALLISON DIVISION OF GENERAL MOTORS, Indianapolis, Indiana



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